34th Year SEPTEMBER, 1950

RUBBER AGE

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ACCELERATE WITH

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General purpose accelerator for Safe Processing and Rapid Cures.

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Exceptionally Fast Curing plus Safe Processing — Excellent for undercut molded articles subject to tear upon removal from mold.

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THIS REPORT TELLS YOU HOW TO

- *Reduce Breakdown Time*
- *Improve Processability*
- *Cut Power Consumption*

with **DU PONT RPAs**

Consult this report, just issued, for complete information on RPAs. Extra copies are available. Just write:

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BETTER THINGS FOR BETTER LIVING ... *THROUGH CHEMISTRY*

RPA #2

SOLID FORM
For natural rubber and reclaim

Supplied in the form of waxy flakes, it is especially suited to open-mill breakdown of natural rubber. Its use materially reduces the time and power required for breakdown. From 0.15 to 0.50 part per 100 parts of rubber is recommended, depending on the time and temperature of milling. RPA No. 2 also aids in producing smooth-processing reclaim stocks.

RPA #3

LIQUID FORM
For natural rubber and reclaim

Preferred for peptizing natural rubber in a Banbury or plasticator because of its liquid form. With this peptizer, it is often possible to eliminate the second pass usually required when plasticating by mechanical means alone. The recommended amounts are the same as for RPA No. 2. It also helps produce smooth-processing reclaim stocks and aids in reducing the viscosity of rubber cements.

In "low temperature" GR-S, RPA No. 3 markedly improves processability . . . results in lower processing temperatures, less scorching, smoother extrusions. Concentrations of 1.0 part or more are generally recommended.

New, improved RPA #3RO

As a result of recent improvements, RPA #3RO now has none of the characteristic odor of RPA #3. The use of this new, improved product is recommended in all applications where odor is a problem.

RPA #5

LIQUID FORM
For GR-S

Especially developed for breaking down GR-S. Its use effectively reduces breakdown time and power consumption . . . helps produce smoother processing stocks with reduced nerve and shrinkage. From 0.5 to 2.0 per cent RPA No. 5 is recommended for breakdown at high temperatures on a mill, or in a Banbury or plasticator.

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc., Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York 19, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $3.00 a year; Canada, $3.50; Foreign, $4.00. September, 1950, Vol. 67, No. 6.

Another development using

B. F. Goodrich Chemical Company ***raw materials***

Crabbing Machine made by Birch Bros., Inc., Somerville, Mass.

Hycar rolls covered by Tyer Rubber Company, Andover, Mass.

The heat's on Hycar in this crabbing act!

IN this Birch Continuous Crabbing Machine, the fabric is passed through boiling water to prevent the formation of creases, puckers and irregular shrinkage. The fourteen Hycar rubber covered rolls squeeze liquid from the fabric as it passes from one vat to another. They operate continuously under comparatively high pressures, must withstand boiling water and steam—as well as detergents, wetting agents and cleaning fluids.

Ordinary roll coverings tend to deteriorate under such punishment, soften and wear excessively. But not roll coverings properly compounded of *Hycar*. For Hycar has unusual advantages—exceptional resistance to high temperature, abrasion, aging, most chemicals and oils. Hycar-covered rolls have operated for many months without the slightest tendency toward softening or deterioration.

What Hycar does here in helping maintain good product performance, and reducing operating costs, may point a way it can help you improve or develop products. Hycar resists oils and solvents, heat, weather and wear—has many more advantages. We'll gladly help you. For technical assistance, please write Dept. HA-5, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio.

Need high tensile strength? Hycar has it—plus abrasion resistance and more advantages.

Hycar Reg. U.S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers

If you would like a faster way

To process stocks—use Philblack* A!

A smoothie in more ways than one! This easy-processing, fast-curing black breaks down and plasticizes GR-S and reclaimed rubber stocks at a rapid rate! Produces more homogeneous mixtures, too, than those obtained with most other blacks. This greater uniformity means longer life in tire treads and carcass stocks.

Use Philblack A in inner tubes for strength, resilience and smooth finish . . . and in *any rubber product* where you need accuracy of extrusion and molding. Plenty of eye appeal, too! Philblack A is shipped in bags or bulk. Send your order today.

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Phillips 66

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best buy

for shoe soles

Tests prove you get more flexibility with PLIOLITE S-6 B

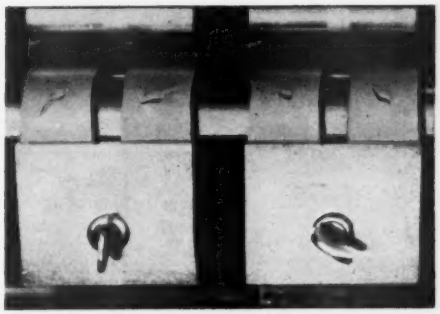
COMPARED with other resins available on the market, **Pliolite S-6 B** in shoe soles gave higher flexibility on the Ross Flex Test Machine, as shown in the inset photograph here. These pierced samples of soles made with Goodyear's new, truly easier processing resin showed markedly longer flex-life.

Shoe sole makers everywhere are turning to **Pliolite S-6 B** because of its ideal combination of qualities—lighter color, higher Shore hardness, low specific gravity, leathery "feel," and ready processability even under marginal Banbury or mill conditions.

This same combination of qualities makes this resin equally attractive to makers of flooring, molded and inflated rubber items, electrical insulation and a wide range of other products.

Why not see what **Pliolite S-6 B** offers you—by sending today for full details and samples for evaluation. Write:

Goodyear, Chemical Division, Akron 16, Ohio



COMPETITIVE RESIN **PLIOLITE S-6 B SAMPLE**

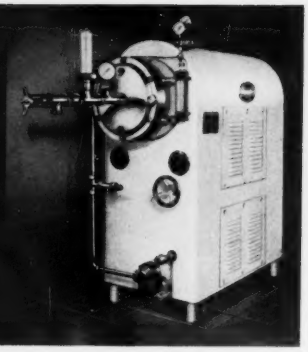
Unretouched photograph illustrates cut-growth of pierced samples of shoe soles made with **PLIOLITE S-6 B**, on right, and a competitive resin, on left. Samples are in duplicate. Compounds differ only in the type of resin used. Note greater resistance to cracking exhibited by the **PLIOLITE S-6 B** sole at equivalent flexing.

USE PROVED *Products*

Pliolite—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

OAKES
CONTINUOUS, AUTOMATIC
FROTHING MACHINE



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Produces latex blow-ups of 6 to 18

Ideal for slab or mold work, rug backings, pillows, mattresses, furniture and automobile upholstery.

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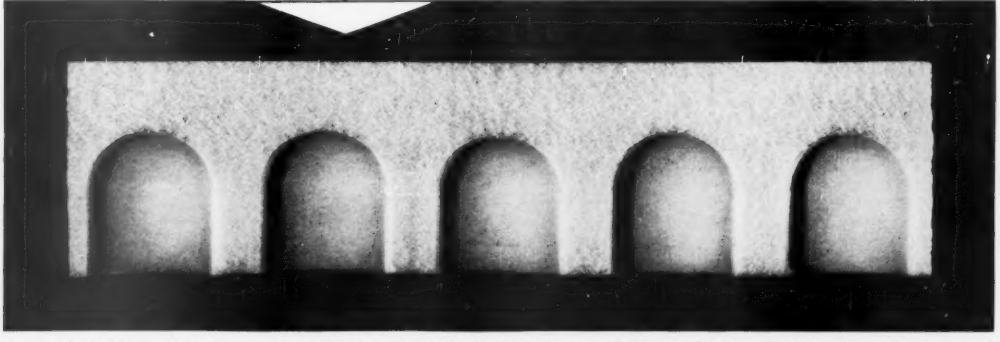

Unretouched photograph of foam rubber frothed on the AMF-OAKES Continuous, Automatic Frothing Machine. (Latex blow-up of 14)

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Plastic latices

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Butadiene acrylonitrile copolymer latex

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Process for rendering woolens shrink resistant and long wearing

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Horizontal storage is usually easier and more efficient — vertical storage has a tendency to curl the edges of the stock and liner, causing stock losses. When your liners are Climco Processed, you can confidently store them horizontally because the pressure of the roll will not cause sticking.

Climco Processed Liners will help you — whatever your method of storage.

They speed work by stopping stock adhesions and insuring easy separation. The life of your liner is increased, tackiness of the stock is preserved and loss of stock reduced. In addition to these production benefits, Climco Processed Liners protect the stock itself in many important ways.

Since 1922 Climco Processed Liners have proved their worth to the rubber industry. Give them a trial in your plant.

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Tells all about Climco Liners and Linerette and how to get better service from liners. Write for your copy now.

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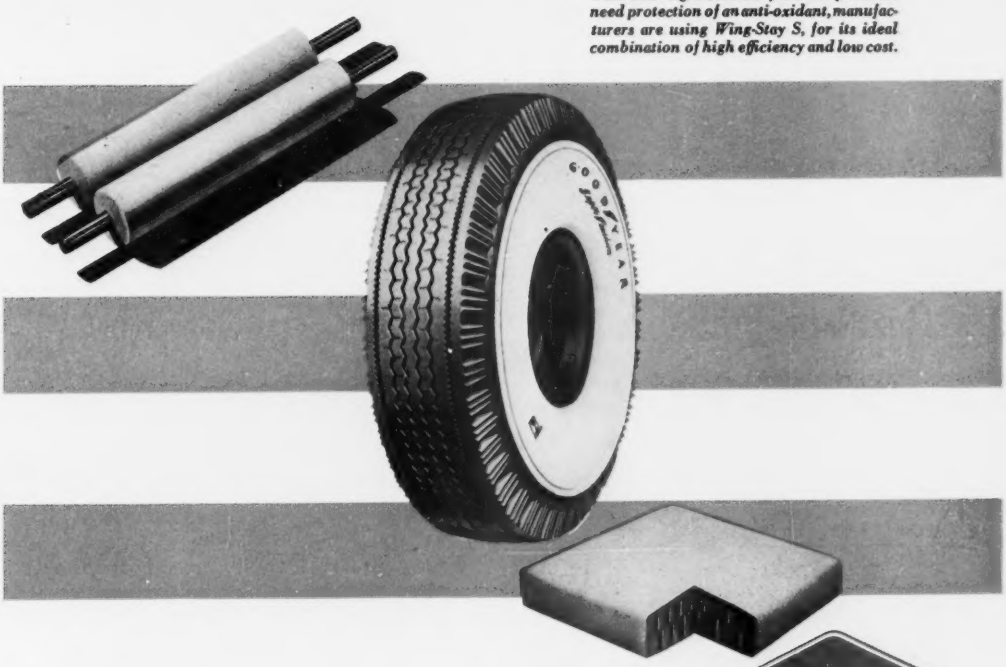
Serving the Rubber Industry for 26 Years

Wherever light-colored finished products need protection of an anti-oxidant, manufacturers are using Wing-Stay S, for its ideal combination of high efficiency and low cost.



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For Non-Staining, Non-Discoloring Your Best Anti-Oxidant Buy is

Wing-Stay S

PROCESSORS of light-colored natural or GR-S rubber products are turning in growing numbers to **Wing-Stay S**—Goodyear's anti-oxidant. For this relatively new product offers the best balance of non-staining, non-discoloring characteristics, anti-oxidant properties and low cost available anywhere.

Wing-Stay S is available in production quantities and is capable of rapid and uniform dispersion in any compound. Users of GR-S 26 have **Wing-Stay S** already incorporated in their stock at the time of manufacture.

Ask for further details on this fastest-growing anti-oxidant, by writing:

GOODYEAR, CHEMICAL DIVISION
AKRON 16, OHIO

GOODYEAR

Wing-Stay, Super-Cushion—T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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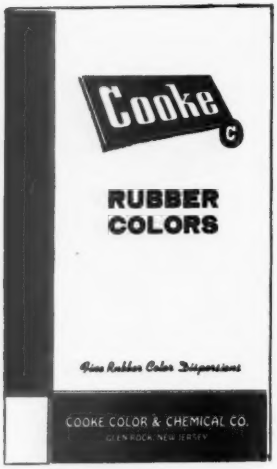
dispersed in neutral rubber polymer...

are available in *quantity for immediate shipment*



Above is shown the cover of our new Color Chart. If you have not received a copy, send for it today. It gives you actual colored rubber samples in more than 20 basic shades which can be blended to get the exact tone you require.

COOKE'S Colors are not affected by shortages or tight supplies of rubber and latex, nor by high prices. They are available for immediate shipment, in any quantity, from large stocks on hand. If shortages are your trouble, we have organic colors available that will take the place of inorganic Blues, Greens, Yellows and Reds.

These colors are furnished as soft dispersions (50% each of organic toner and neutral polymer). They are unsurpassed for aging properties and will stand long storage and temperature changes. They have high tinctorial value and give a clean, bright tone to the finished product.

COOKE'S Colors are quality colors for use in Natural or Synthetic Rubber and in Vinyl Plastics. They will stand all cures, are non-bleeding and non-migrating, and assure an exact color control of your products. COOKE'S Colors are unmatched for depth of tone, high stability, permanency, and ease of handling.

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Plant and Laboratory: Hackettstown, N. J.

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CARBON BLACKS

UNITED BLACKS, made with engineering and scientific skill to meet the needs of the rubber industry, are "packaged" to suit the convenience of the user. In this photo a hopper car is being filled; distinctive United Carbon bags, plainly printed for ease in handling and selecting, are another medium which United uses to make handling convenient, fast, and easy for the user.

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AN HMF BLACK

PACKAGED IN BLACK BAGS WITH DISTINCTIVE GREEN PRINTING

LOW COMPOUNDING COST
WIDE FLEXIBILITY
EASY PROCESSING
FAST RATE OF CURE
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HIGH RESILIENCY
LOW HEAT BUILD-UP
RAPID EXTRUSION
MINIMUM FLEX CRACKING
GOOD AGING

For economy, exceptional performance, and all-around satisfaction standardize on Kosmos 40, an HMF (high modulus furnace) black.

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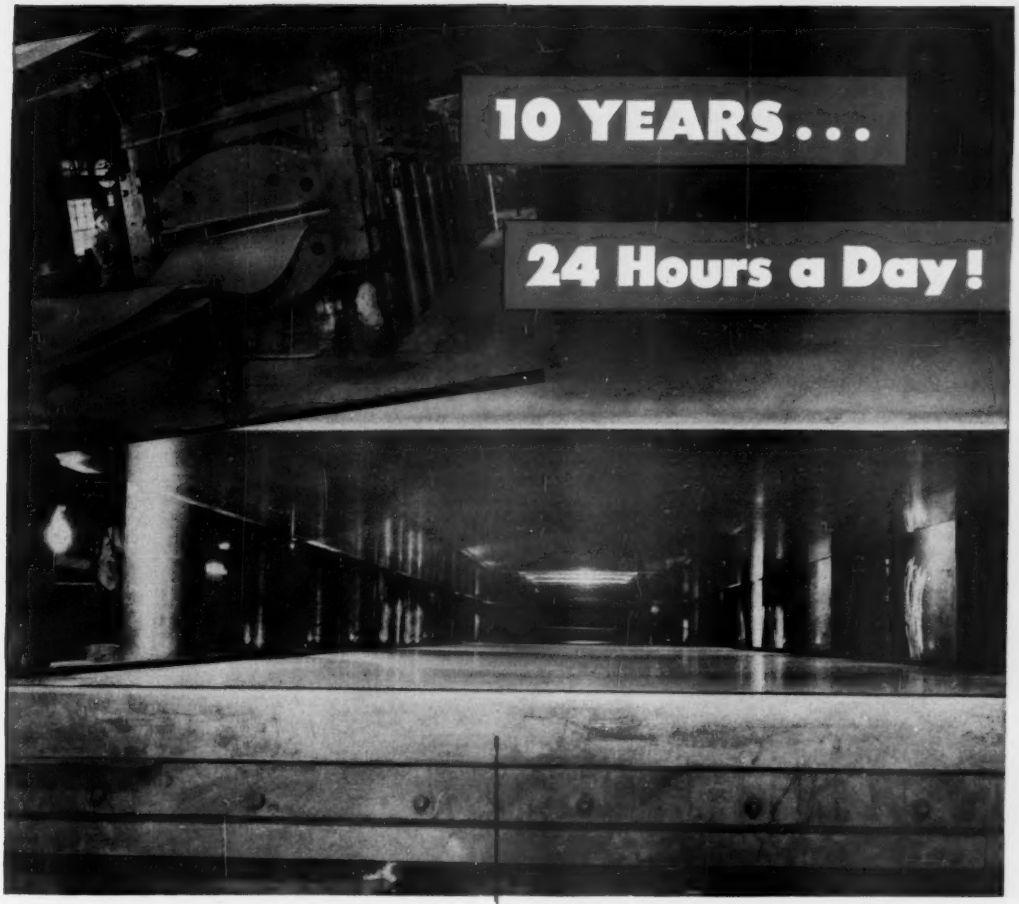

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Established 1803

The unretouched photograph above shows two 30′ x 5′4″ R. D. Wood press heating platens which have been turning out transmission and conveyor belting, packing, and similar industrial rubber products for the Thermoid Company of Trenton, New Jersey, for 10 years—working 24 hours a day.

Part of the R. D. Wood 3180 ton single opening hydraulic belt press pictured, these mirror-surfaced platens, in addition to the press itself, are still in excellent condition after over 87,000 hours of work, and give the Thermoid Company the quality it demands of its products, together with reduced production costs, fewer rejects, little maintenance.

Such performance from R. D. Wood hydraulic equipment can mean profit in *your* operations. R. D. Wood manufactures hydraulic presses and equipment for the rubber, plastics, plywood and metalworking industries. Write for information.

HIGH GRADE CALCIUM CARBONATE EXTENDERS AND FILLERS FROM SELECTED CRYSTALLINE MARBLE

GamaCo

Because of its low top particle size, GamaCo gives unusual performance as to extrusion rate, flex resistance, and abrasion resistance. In comparison with other similar pigments it will show moderate increases in modulus and tensile strength. These tendencies are due in part to its straight line distribution—and the absence of an excess of extreme fines. GamaCo disperses relatively quickly and thoroughly.

CALWHITE

Calwhite's particle size range makes it of interest in extruded goods and proofed goods where dry ground products (a small percentage of the particles which are usually over 40 microns) create processing and finishing problems. Compared with other similar pigments the slight reduction in its particle size permits increased loadings of 20-50% without loss of physical properties.

CHECK THESE ADVANTAGES OF GEORGIA MARBLE CALCIUM CARBONATE

1. Uniformity of color, particle size, moisture content, packaging—safeguarded by constant control.
2. Unlimited company owned and operated natural resources.
3. Three large New Mills (built post war) with the most modern equipment for producing water ground and air floated, classified calcium carbonate pigments.
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6. Mixed carloads at carload prices.

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CALCIUM PRODUCTS DIVISION

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AERO Brand Stearates are produced by a new process under continuous chemical control to assure the highest purity and uniformity. Available in exclusive multi-wall paper bags for economical handling.

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RUBBER & PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO **NRM** REDUCE YOUR COSTS

Many Variables Affect Special Extruder Applications

There is no "standard extruder" suitable for maximum efficiency in every application

There are many factors which must be taken into consideration when determining special extruder applications. Some of these factors and variables which affect operation are: (1) the nature of the compound (2) the size and shape of the section (3) the type of feed (4) the condition and form of the material as it is brought to the extruder (5) the type and style of die head (6) the condition of the extruder itself, such as amount of wear, type of drive and other factors.

Taking item 6 above, as an example, one may easily see how the character of the extrusion would be altered if condition of machine wear were to be ignored. For instance, the clearance between the extruder screw and liner varies with the number of hours of use and types of compounds run through the cylinder.

Following is a ready reference chart on clearances for new NRM tubers and the maximums of "worn-in" clearances for efficient operation:

Size Extruder	Total Diametrical Clearance Between Screw and Bore of Cylinder Liner: New Machine	Used Machine (Maximum)
2½"	.007" to .009"	.025" to .030"
3¼"	.008" to .010"	.028" to .033"
3½"	.010" to .012"	.030" to .035"
4½"	.010" to .012"	.030" to .035"
6"	.012" to .016"	.050" to .055"
8"	.013" to .016"	.055" to .060"
8½"	.013" to .016"	.055" to .060"
10"	.017" to .020"	.060" to .065"
12"	.017" to .020"	.060" to .065"

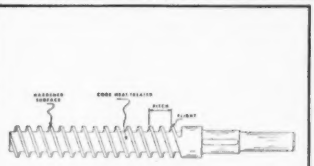
In addition, the equipment engineer should always consider the machinery design features which can affect operations on special extruding jobs. Some of these are:

1. Drive—Variable speed DC or constant speed AC with variable speed coupling.
2. Transmission—Worm gear or double herringbone gear reductions.
3. Quick changeability of screws, liners, and dies.
4. Screw characteristics, single or double lead, constant or variable pitch, stelliting or flame-hardening.
5. Length of cylinder and screw; and position and size of hopper.

Because of the many variables involved, it should be clear that there is no such thing as a standard extruder that can be used for every application. Each installation must be carefully analyzed and consideration given to performance records on similar applications.

One thing you can plan on in every case—when you buy NRM you're taking advantage of over 30 years' creative engineering *and* actual manufacture experience devoted to extrusion equipment. Result: exclusive features which pay off in terms of higher quality extrusions at lower cost wherever NRM equipment is properly applied.

For complete details on NRM machinery or assistance in analyzing your extrusion processes, write or wire NRM, 47 West Exchange St., Akron 8, Ohio. No obligation!



NRM Extruder Screw showing special design features. "NRM specializes in screw designs".

EXTRUDING COLD RUBBER, OTHER SYNTHETICS REQUIRE SCREW CHANGES

As change-overs from natural rubber compounds to synthetics were made, it was found necessary to change extruder screw characteristics. The changes made compensate for differences in the frictional heat generated and for varying compression requirements.

Now, with the advent of "Cold Rubber", it has been found necessary to again examine screw flight characteristics so as to obtain maximum efficiency and quality of extruded product.

For example, changing compression ratio was indicated in order to get uniform flow from the die with no tendencies to pulsate. Also, the most success is now being obtained with a double flight screw (*see drawing at left*).

In addition, cold rubber extrusion has also made it necessary to change the flight contours or fillets between flights and the root diameter. Corrosive tendencies of cold rubber have also required a change in the surface condition of the entire flight length.

You can obtain complete, detailed information on rubber extrusion and processes by writing NRM—*specialists in screw design.*

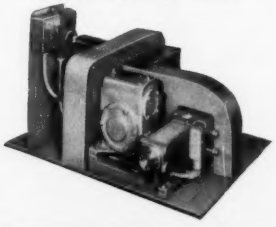
Small, Compact Bench Model Extruder Ideal for Lab. Work

NRM's 1" Bench Model extruder is small, compact and versatile. With a nominal capacity of 6-10 lbs. per hour, the Bench Model is *tops* for either laboratory work, small capacity regular production or both.

Particularly, the 1" model is ideally suited for laboratory operations where runs are small. A large volume of stock is not required to load the Bench Model's cylinder. The 1" extruder is complete with a ¾ hp. AC motor, a worm gear reducer and interchangeable spur gears to give a wide range of screw speeds and a vari-pitch sheave for fine speed adjustment.

The NRM Bench Model is suitable for checking extruding characteristics on many types of compounds through various die shapes including a small crosshead. Write for complete information on ways this 1" "pilot plant" can save you time, trouble and money!

The NRM 1" Bench Model is available both for electrical or steam heat. The cylinder is lined with a hard-surfaced, long-wearing Xaloy material.



NATIONAL RUBBER MACHINERY CO. General Offices & Engineering Laboratories Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
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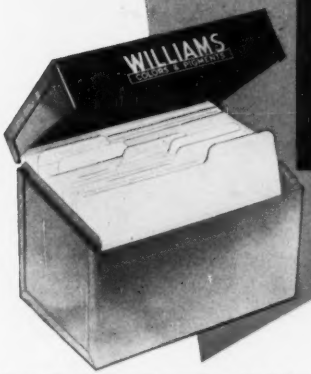
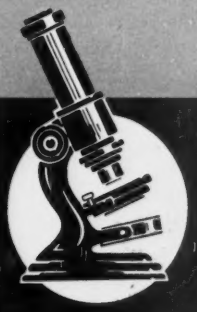
Each is manufactured to rigid specifications for copper and manganese content, pH value, soluble salts, fineness, color, tint and strength by controlled processes and with special equipment. The result is absolute uniformity of product.

If you haven't already done so, try these finest of all iron oxide colors. Your own tests will show there is no equal for Williams experience.





LET WILLIAMS PUT THE MICROSCOPE ON *Your* COLOR PROBLEM

Whatever your color problem, bring it to Williams. Our 72-year experience can often save you time, money, and headaches in proper color formulation.

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Even in a part that very few people ever see, high surface finish is frequently mandatory. In precision parts like these automotive crankshaft oil seals, the slightest nick or surface blemish could make a lemon of a high priced car. That's why National Motor Bearing Company, one of the largest suppliers of such precision molded oil seals, depends upon DC Mold Release Emulsion No. 35B to give the kind of release and finish they need.

Whether you mold tires or mechanical goods, heels and soles, floor tile, or bottle stoppers, you can't escape the demand for high surface finish—or the need for Dow Corning Silicone mold release agents. They give more sales appeal and better performance. They reduce scrap to the vanishing point and cut mold maintenance by as much as 80%.

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United rolls are in use in leading processing plants throughout the world. Their wide acceptance is the result of progressive research and more than 30 years experience in roll design and manufacture.

Consult us on your next requirement. Our engineers will be glad to assist you when specifying for conventional applications or for new or unusual processes.

Designers and Makers of Rolls and Rolling Mill Equipment

Need more protection?

STABILITE*

THE ANTIOXIDANT WITH UNIQUE CHARACTERISTICS

When looking for the most economical and outstanding antioxidant for both natural and synthetic rubber, consider STABILITE, which has, combined in one material, the following characteristics:

1. *Protection against oxidation and heat, sunchecking and mechanical flexing.*
2. *Distinct softening effect on uncured rubber or GR-S, resulting in better processing and dispersion, smoother calendering and tubing and at the same time without effect on modulus at cure.*
3. *The unique property of increasing the effect of most commercial antioxidants when used in conjunction with* STABILITE. *The effect of such mixtures is greater than the components.*

For the protection of your rubber products use STABILITE; for maximum resistance to oxidation, heat, sunchecking and mechanical flexing replace part of your present antioxidant with STABILITE.

*MANUFACTURED BY CHEMICO, INC.
THE C. P. HALL CO. *Manufacturing Agents*

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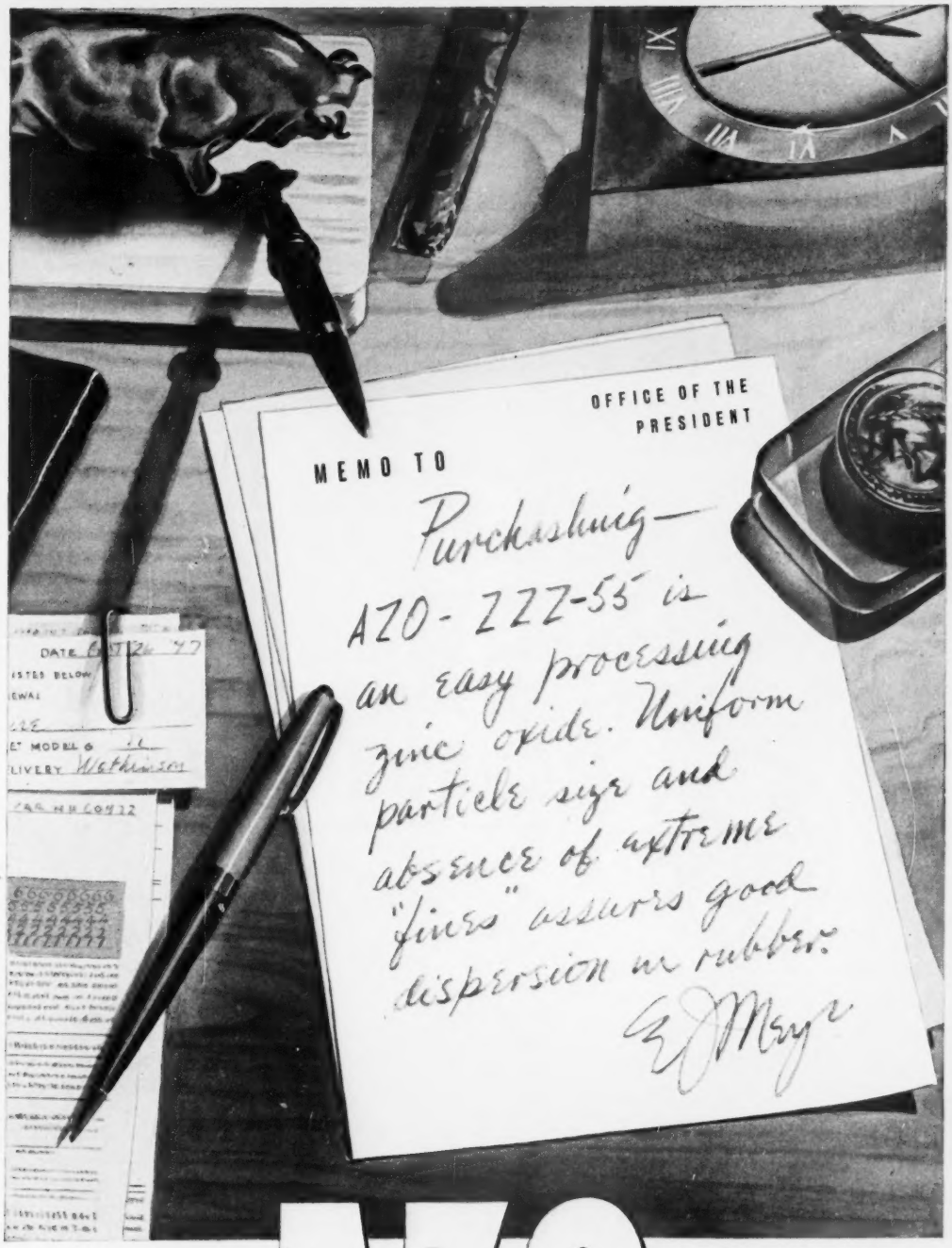

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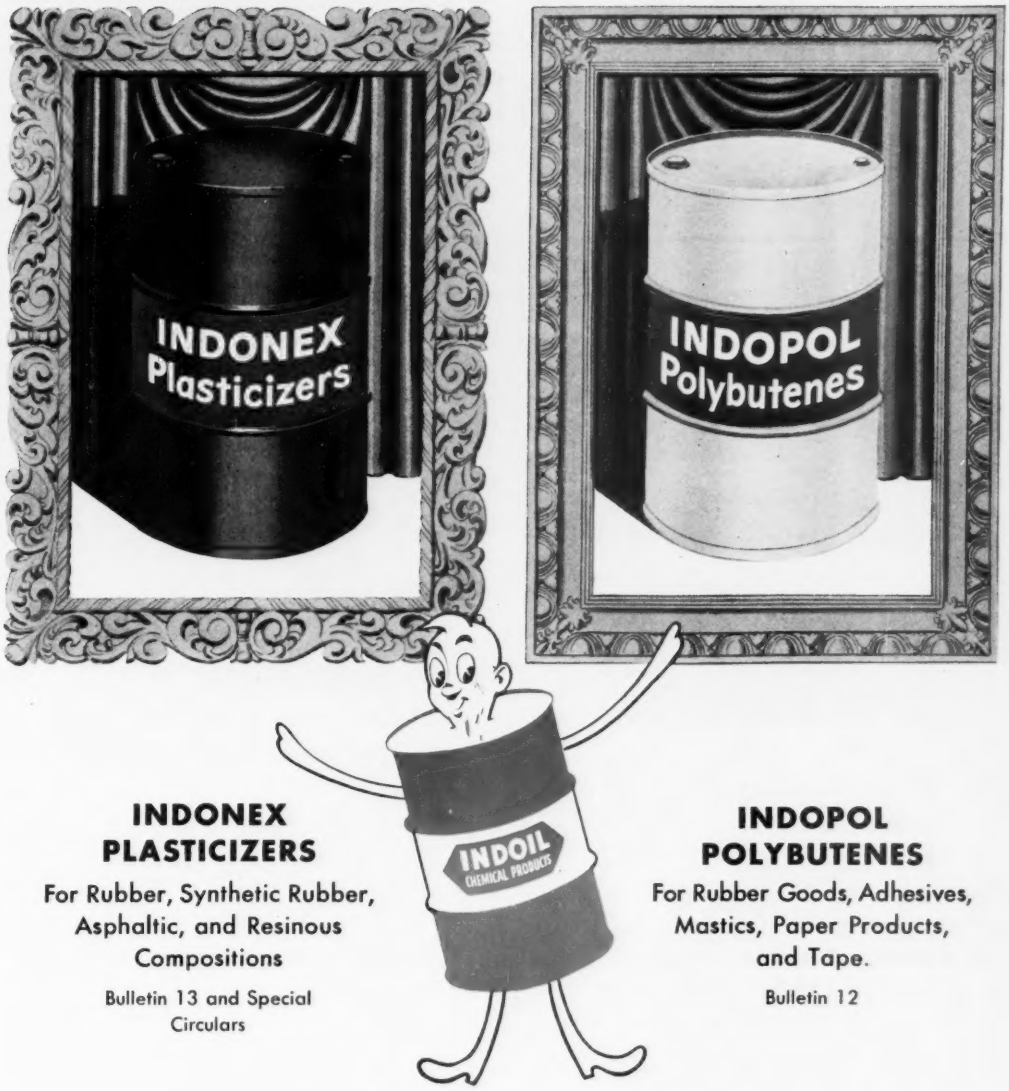

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Bulletin 12

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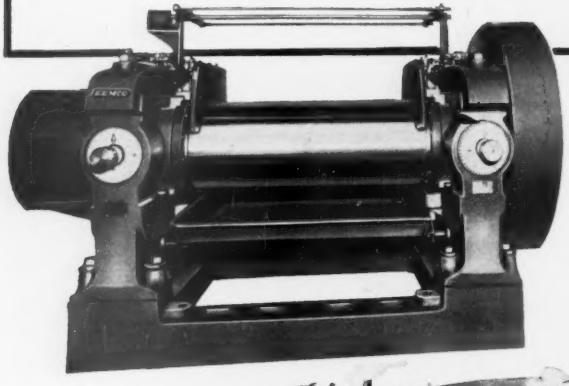
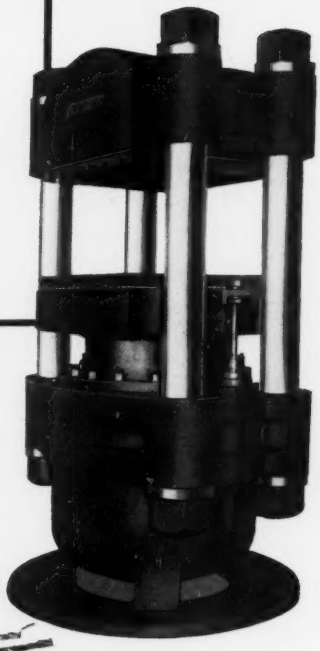
CHEMICAL PRODUCTS

Heavy Duty
MILLS AND PRESSES





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In this large modern factory rubber and plastics machinery has been built for the past 35 years. With installations throughout the world, EEMCO mills and presses are built for long life and heavy duty and are made by expert craftsmen to give unexcelled performance. EEMCO has its own Foundry, Machine Shop, Engineering Department, and Assembly Floor to insure fast delivery. Before you buy, get price and delivery dates from EEMCO.

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How NEVILLE can serve the Rubber Industry

RUBBER SOLES AND HEELS

Improve Product Quality, Save Production Costs, with NEVILLE RESINS

The coumarone resins are used in the manufacture of rubber soles and heels to reduce set and leatherize the compounds. They are extender-plasticizers which do not lower hardness, tensile, modulus or tear. The grades used generally are medium high melting points and of light to dark color, depending on the color of the stock.

The most popular grades, in order of lightest color first, are R-13, R-14, R-15, R-16 and R-16A, and the low cost, quite dark Paradene #2. These resins are also used as extender-plasticizers in compounding the new plastic-type soles.

Why not call on Neville's years of research and experience for help on your rubber production problems?

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Chemicals for the Rubber Industry

THE NEVILLE COMPANY

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R-42

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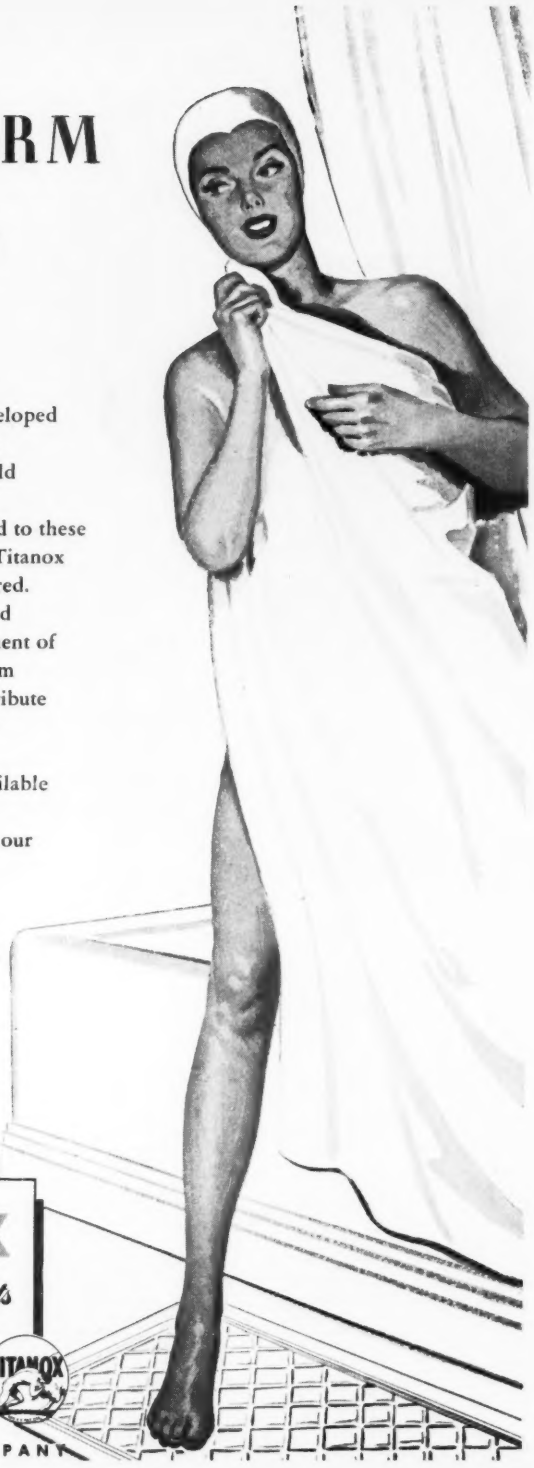
MODERN rubber technology has recently developed a warm suede-like finish for rubber shower curtains and bathmats that banishes forever the cold clammy clasp of wet rubber.

Outstanding brightness and opacity are imparted to these products—like so many other modern articles by Titanox pigments, whether whiteness or soft tints are desired. For the more heavily loaded stocks such as are used in bathmats, TITANOX-RCHT is the titanium pigment of choice. All Titanox pigments whether pure titanium dioxide or titanium dioxide-calcium sulphate contribute superior pigment properties economically and are compatible with all types of rubber.

Our Technical Service Department is always available for consultations on your pigmentation problems with all kinds of rubber products. Write or phone our nearest office. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; 104 South Michigan Avenue, Chicago 3, Ill.; 2600 South Eastern Avenue, Los Angeles 22, Calif. Branches in all other principal cities.



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MONSANTO ACCELERATORS . . . A-32 • A-77* • A-100 • Butasan* (Zinc N,N-Dibutyl-dithiocarbamate) • DPG (Diphenylguanidine) • El-Sixty* (Di-[2-benzothiazyl-thiomethyl]-urea) • Ethasan* (Zinc N,N-Diethyl-dithiocarbamate) • Ethyl Thiurad (Tetraethyl-thiuram-disulfide) • Guantal* • Mertax • Methasan* (Zinc N,N-Dimethyl-dithiocarbamate) • Mono Thiurad* (Tetramethyl-thiuram-monosulfide) •

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for the RIGHT accelerator, look to MONSANTO

Whether your rubber products are thick or thin . . . light or dark . . . natural, reclaimed or synthetic . . . you can find the *right* accelerator among those in regular production at Monsanto's big plant devoted to the development and production of rubber chemicals. For your free copy of the 32-page booklet, "Monsanto Chemicals For The Rubber Industry," and for data and quotations on any Monsanto Chemical, mail the coupon or contact MONSANTO CHEMICAL COMPANY, 920 Brown Street, Akron 11, Ohio.

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Please send, free and without obligation, the booklet, "Monsanto Chemicals For The Rubber Industry," also data and quotations on the following.....

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SERVING INDUSTRY . . . WHICH SERVES MANKIND

NOW! 2 "PROTOX" ZINC OXIDES 166 and 167

FOR FASTER PROCESSING ● FOR HIGHER REINFORCEMENT

Both Protox-166* and Protox-167* bring you all the well-known advantages of American Process Zinc Oxides . . . *plus* these important features:

- Faster, more uniform mixing
- Quicker, smoother tubing and calendering
- Improved tensile and tear resistance
- Higher modulus and resilience

Which Protox should you use? Consider these points:

1. Protox-166 and Protox-167 are essentially identical in processing and reinforcement properties, as indicated in the table below.

2. In Protox-167, dusting is practically eliminated and dispersions are even somewhat improved in comparison with Protox-166.

3. Protox-166 should be continued in use where water suspensions of Zinc Oxide are involved, as Protox-167 is resistant to wetting by water.

WHICH PROTOX DO YOU WANT TO TEST *NOW*?

COMPARISON OF PROTOX-166 AND PROTOX-167 ZINC OXIDES . . .

Identification	Time of Cure (Min. at 20 lb.)	Tensile Strength (Lb./Sq. In.)	Per Cent Elongation	Load (Lb./Sq. In.) for Elongation of 300%	Load (Lb./Sq. In.) for Elongation of 500%	Abrasion Resistance (Feldspar)	Shore Hardness	Tear Resistance	Min. to T-50 at 0°C
[redacted]	10	675	700	120	315		31	25	39
	15	2200	670	440	1160		38	66	
	30	3420	655	660	1980	84	44	231	
	45	3560	635	785	2235	105	48	286	
	60	3600	620	825	2320	113	50	234	
	75	3515	605	850	2380		51	269	
	90	3380	585	855	2400		51	227	
[redacted]	10	1520	690	240	760		34	35	37
	15	2700	680	475	1390		39	87	
	30	3335	635	705	2000	82	45	237	
	45	3460	625	745	2120	101	48	325	
	60	3500	605	810	2300	106	49	306	
	75	3480	600	840	2320		50	308	
	90	3420	600	885	2340		51	270	

Identification	Time of Cure (Min. at 20 Lb.)	Goodyear-Healey Pendulum: Indentation in mm.	Goodyear-Healey Pendulum: Per Cent Rebound	Goodyear-Healey Pendulum: Hardness (of Block) Shore Rex	Compression Fatigue (Goodrich Flexometer)*: Running Per Cent Initial Comp.	Compression Fatigue (Goodrich Flexometer)*: Running Time and Per Cent Permanent Set	Compression Fatigue (Goodrich Flexometer)*: Running Max. Temp. Rise (°C.)	Compression Fatigue (Goodrich Flexometer)*: Dynamic Compression Initial	Compression Fatigue (Goodrich Flexometer)*: Dynamic Compression Final	Cut-Growth Resistance Tested at 70°C. Inches Failure 90,000 Cyc.
[redacted]	60	9.31	83.4	47 50	20.4	15'-2.9	8.7	5.8	7.1	.65
[redacted]	60	9.25	84.1	48 51	21.1	15'-2.7	8.6	6.3	7.1	.73

FORMULA

Smoked Sheet	100
Sulfur	3
MBT	1
Agerite Powder	1
Stearic Acid	3
Zinc Oxide	100

***TEST CONDITIONS:** Load—93 psi. Stroke—0.25 inch Oven Temp.—100°C.

	Williams 3' Plast.	Plasticity Recovery
[redacted]	2.35	.15
[redacted]	2.40	.17

*U.S. Patent 2,303,330

HORSE HEAD PRODUCTS

THE NEW JERSEY ZINC COMPANY

Founded 1848

160 Front Street, New York 7, N. Y.

HERE IS
ONE REASON . . .
The body of a chilled iron roll is formed by pouring molten metal into an iron mold or chill. Iron being a good conductor of heat, cooling is rapid, causing the surface of the roll body to "chill" and harden. The body of the roll below the chilled surface cools slowly, forming a gray iron structure which gives strength to the roll. Sand molds are used for the necks, and, since sand is a poor conductor of heat, the metal becomes a gray iron composition with physical properties which make the necks strong, yet readily machinable.
HOPPER FOR POURING
RUNNER
ROLL
FLASK
FLOOR LEVEL
CHILL
CASTING PIT
CHILL
FLASK
GATE
SAND

why Farrel-Birmingham Rolls *last so long*

The depth of the white iron "skin" or chill is one of the principal factors affecting the service life of a chilled iron roll.

In every Farrel-Birmingham roll the thickness of chill and gray iron body are combined in correct proportion to provide *maximum service*. The chilled section is sufficiently deep to resist crushing and abrasion, and the gray iron structure of the body beneath gives adequate strength to carry the load imposed on the roll in the service for which it was designed.

Experience in building a wide variety of roll-equipped processing machines guides company engineers in determining the proper depth of chill. Then the rolls are cast so true and with such accurate contours that they require a minimum of turning and grinding to finish to size. This casting accuracy is responsible for the full, uniform depth of hard chilled surface being retained nearly as cast.

Proper depth of chill is only one of the reasons why it pays to order your roll renewals from the *world's largest specialty roll shop*. Write for information about rolls for specific applications.

FARREL-BIRMINGHAM COMPANY, INC. • ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

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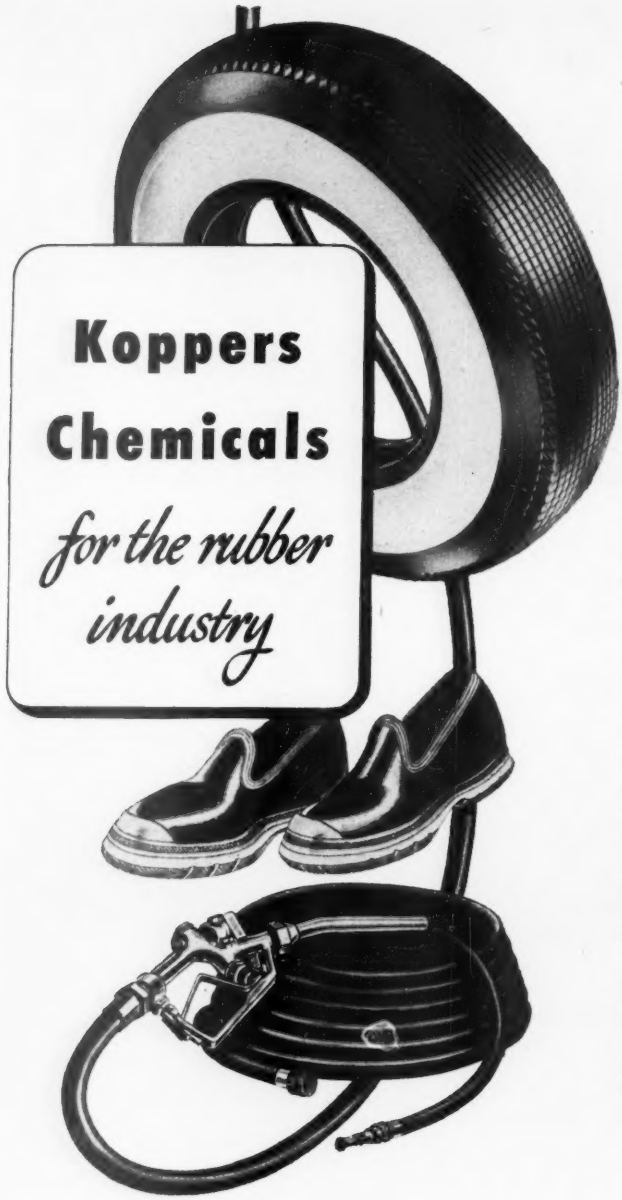

★ **RESORCINOL** is used for preparation of adhesives that assure a strong bond between rubber and fabric or cords. Koppers Resorcinol used in pre-dip treatment produces excellent bonding of rubber to cotton, rayon and nylon fabrics.

★ **Di-tert-BUTYL-para-CRESOL** has wide application as an antioxidant in white rubber products. It retards cracking, checking, hardening or loss of strength without discoloring the product or staining materials with which the product comes in contact.

★ **STYRENE MONOMER** polymerizes with active olefinic compounds to produce GR-S type synthetic rubbers.

★ **Di-tert-BUTYL-meta-CRESOL** is suggested for use in the preparation of hard rubber or ebonite from GR-N synthetic rubbers. It is reported to improve tensile strength of ebonite and increase tackiness of the stock. Sulfides of DBMC have been reported to be effective peptizing agents for reclaiming of GR-S type synthetic rubbers.

★ **MONO-tert-BUTYL-meta-CRESOL** has been reported to be an effective anti-flex cracking agent in rubber and rubber-like materials. And the resin obtained by condensation of MBMC with formaldehyde has been shown to impart tack to GR-S rubber.

WRITE FOR INFORMATION ON THESE CHEMICALS

Koppers has prepared a new bulletin containing information and structural formulae on 26 synthetic chemicals offered in commercial quantities, including these five chemicals of special interest to the rubber industry. For your copy, write to Koppers Company, Inc., Chemical Division, Dept. RA-9, Pittsburgh 19, Pa. Ask for Bulletin C-9-103.

KOPPERS

KOPPERS COMPANY, INC.

Chemical Division

Pittsburgh 19, Pa.

When it's PELLETEX you KNOW...

It's the BEST

A visit to a PELLETEX plant shows the latest and best refinements of process and equipment. Every step from gas to black is under scientific control. Trained engineers keep those controls keyed to perfection. Laboratory men, production men, maintenance crews, shippers and packers — all experts in their fields — work harmoniously to bring you the best in SRF carbon black — PELLETEX.

Efficiency at the plant is reflected in the uniform high quality of PELLETEX, the ideal semi-reinforcing carbon pigment for the rubber manufacturer.

The GENERAL ATLAS Carbon Co. 77 FRANKLIN ST., BOSTON, MASS.

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Raw Materials Company, Boston
H. N. Richards Company, Trenton
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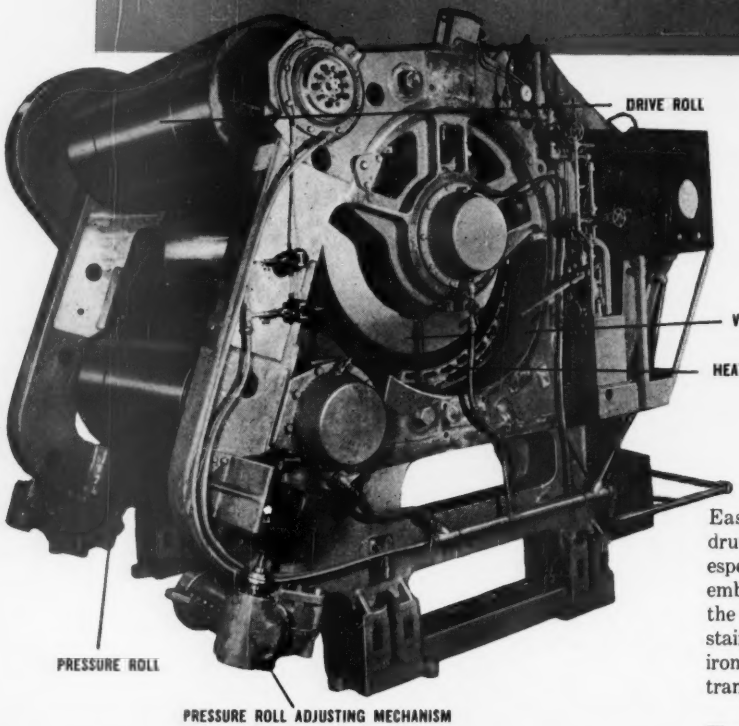
A completely new and redesigned

FOR CONTINUOUS

Permits roll and belt

A NEW ROTOCURE, DESIGNED TO GREATLY FACILITATE REMOVAL OF THE VULCANIZING DRUM AND REPLACEMENT OF THE STEEL BAND, IS NOW AVAILABLE AS A RESULT OF COOPERATIVE ENGINEERING BY ADAMSON UNITED COMPANY AND BOSTON WOVEN HOSE AND RUBBER COMPANY



Easy removal of the Vulcanizing drum to make quick roll changes is especially important when use of an embossed curing roll is necessary, as in the production of floor matting and stair treads. The changing of edge irons when producing conveyor or transmission belting is also facilitated.

The pressure (gauging) roll will withstand a separating force of 250,000 pounds per adjusting screw. It is contemplated that certain stocks can be calendered and cured in a single operation, gauging being accomplished between the pressure roll and the curing roll.

ADAMSON UNITED COMPANY

AKRON 4, OHIO

SUBSIDIARY OF UNITED ENGINEERING & FOUNDRY COMPANY

BRANCH OFFICES IN PRINCIPAL CITIES

ROTOCURE*

VULCANIZATION

changes in 1/10 th the time!

One piece housings provide adequate "window" clearance for removal of the curing roll. A special "C"-Hook is furnished for supporting the roll as illustrated. All design details have been engineered to facilitate and speed roll changing. For example, all supply and return lines are quick-disconnect type. The heating shoes surrounding the Vulcanizing roll are automatically retractable.

Some desirable features:

- **All rolls are supported in self-aligning roller bearings, oil flood lubricated.**
- **Speed range is adjustable from ½ to 6.2 feet per minute.**
- **Vulcanizing roll is 60" diameter; 80" face.**
- **Tension roll is hydraulically actuated; maximum belt tension, 240,000 pounds.**

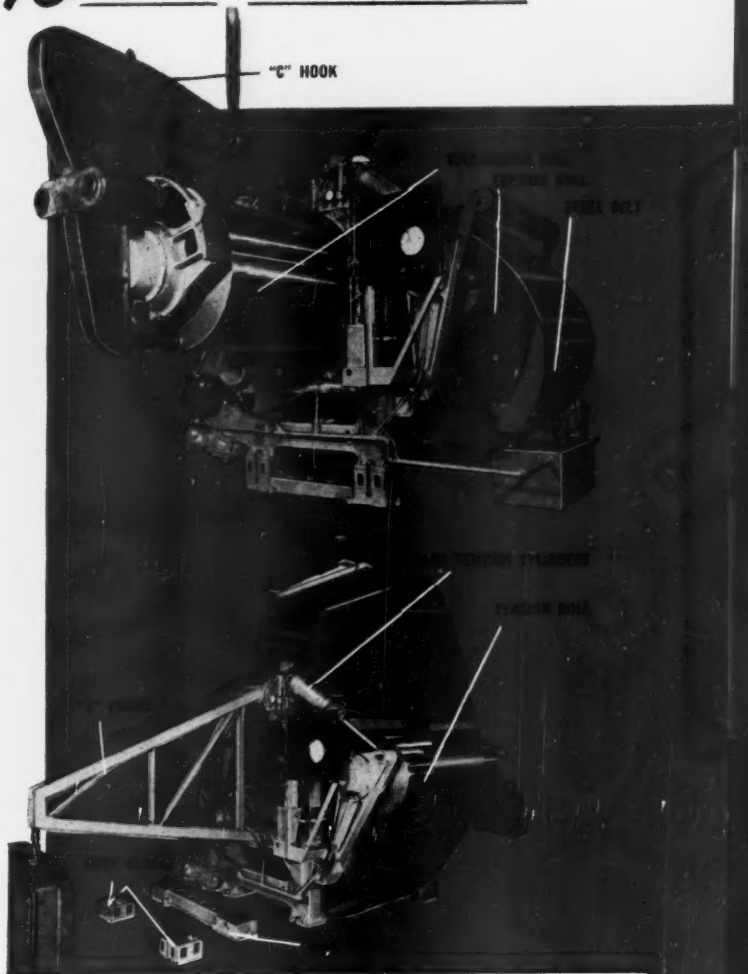
Easy replacement of the steel band is made possible by the ingenious arrangement illustrated. After the curing roll has been removed, the specially provided "A-Frame" is bolted in place and jacked up far enough to remove the weight from the base rail on the near side. The two "foot blocks" are then taken out, permitting the belt to be removed through the resulting opening.

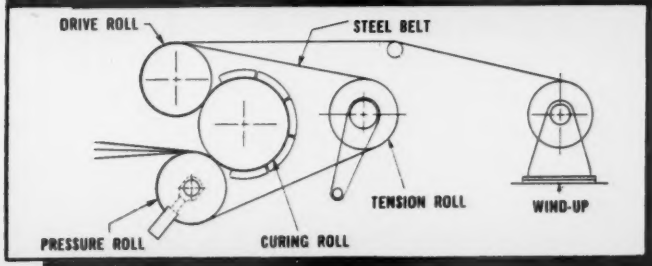
Operation of the Rotocure is shown schematically at right. The Rotocure has many advantages over the conventional press on large production runs. For example:

- **Increased production provided by continuous operation, which eliminates opening, cooling, reheating and closing.**
- **Elimination of overcuring and undercuring of the over-lap areas occurring on conventional presses.**
- **Greater uniformity of stretch.**

Our engineers are available for consultation concerning the possibilities of the Rotocure for your particular products.

**The Rotocure machine is a patented development of Boston Woven Hose and Rubber Company built by Adamson United Company under a licensing arrangement.*





CONTENTS

- A Short History of the St. Joseph Lead Company
- The Production of St. Joe Zinc Oxides
- General Properties of Zinc Oxide
- Zinc Oxide in Rubber Compounds
- St. Joe Rubber Grade Zinc Oxides
- Zinc Oxide in Protective Coatings
- St. Joe Paint Grade Zinc Oxides
- Zinc Oxide in the Chemical, Pharmaceutical and Other Industries
- Zinc Oxide in the Ceramic Industries
- St. Joe Ceramic Grade Zinc Oxides

As the table of contents indicates, this 55 page, illustrated book is a comprehensive manual on zinc oxides in general, and on ST. JOE Lead-Free ZINC OXIDES in particular. In preparing the book, we have included only that material which we considered to be of maximum interest and value to technologists in the consuming industries.

PLEASE WRITE FOR YOUR COPY ON YOUR COMPANY LETTERHEAD

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE, NEW YORK 17 • PRODUCERS OF LEAD-FREE ZINC OXIDES

solving your problems is a specialty of

WITCO-CONTINENTAL technical service

Do you have some questions concerning the use of carbon black in rubber compounding or other fields? Witco-Continental at its new Technical Service Laboratory in Chicago has a staff of experts who are specialists in solving such carbon black problems.

This same staff is also constantly developing data on new products and formulations useful to the rubber industry, and from time to time issues Technical Service Reports and Bulletins to keep the field informed of these findings. If you are not already on our mailing list, your name will be added upon request.

Check your requirements against these WITCO products:

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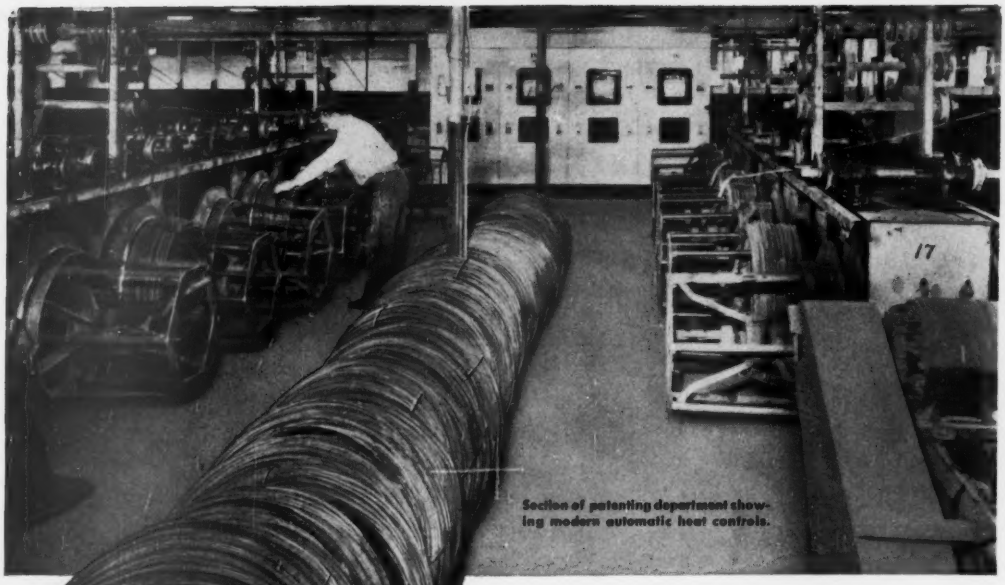

Section of patenting department showing modern automatic heat controls.

wire control

to save you money!

• The accuracy with which your wire specifications are met, *and held,* quite naturally has an important bearing on the cost, speed and quality of your production. That's why you can profit by National-Standard's facilities and exceptional experience in producing special wire . . . either single or in fabricated braid and tape for tires and all other wire-in-rubber products.

Here, all phases of wire processing . . . drawing, cleaning, heat treating, plating, finishing . . . are controlled to a degree and accuracy never exceeded, not often equalled. It's a firmly rooted National-Standard policy that can save you time and money.

Remember, too, another National-Standard policy that can work to your advantage—highly qualified engineering service in the development and application of special wire to solve special problems. As always, it's yours for the asking.

NS NATIONAL-STANDARD Company NILES, MICHIGAN

DIVISIONS OF NATIONAL-STANDARD CO.

ATHENIA STEEL.. *Clifton, N. J.*	Flat, High Carbon, Cold Rolled Spring Steel
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WORCESTER WIRE WORKS.. *Worcester, Mass.*	Round Steel Wire, Small Sizes

for the
finest
in natural
rubber

No. 1 Thin and/or Thick Pale Latex Crepe—Plus containing

Pepton® 22 Plasticizer

Add PEPTON 22 to the latex prior to coagulation and you have No. 1 Thin and/or Thick Pale Latex Crepe—Plus, the finest rubber on the market.

PEPTON 22 can be added to latex at the plantation or in the mill. In either case, it reduces breakdown time at least 50%, cuts power consumption and improves the processing qualities of rubber—with no effect on physical or aging characteristics.

You'll profit by specifying PEPTON 22 for all your plasticizing; it assures the production of better rubber for better rubber products.

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AMERICAN Cyanamid COMPANY
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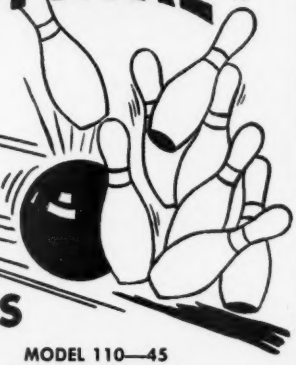
ANOTHER STRIKE!



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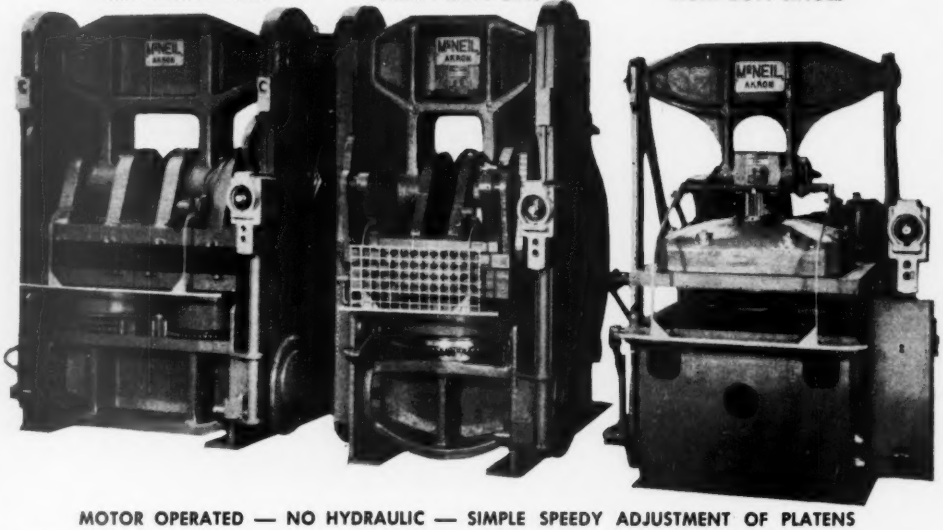

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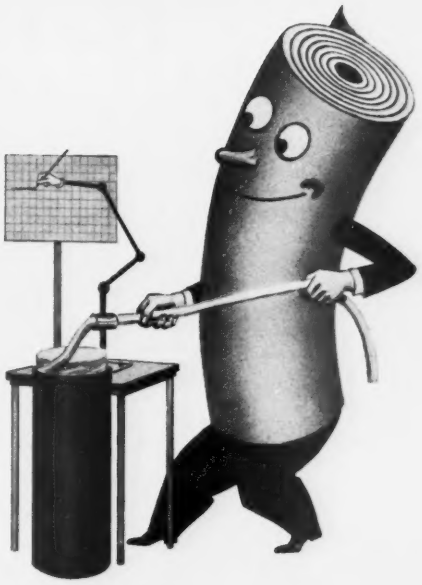

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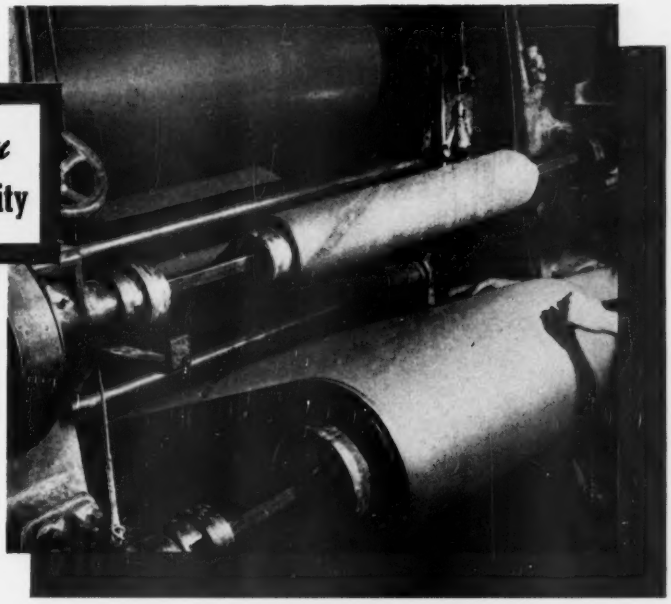

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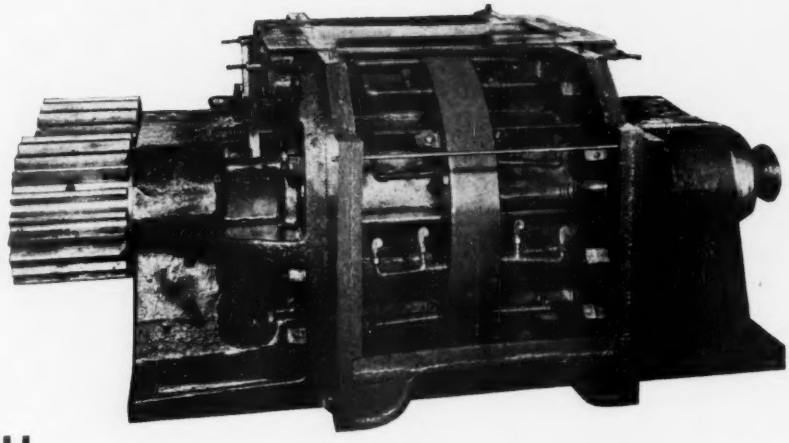

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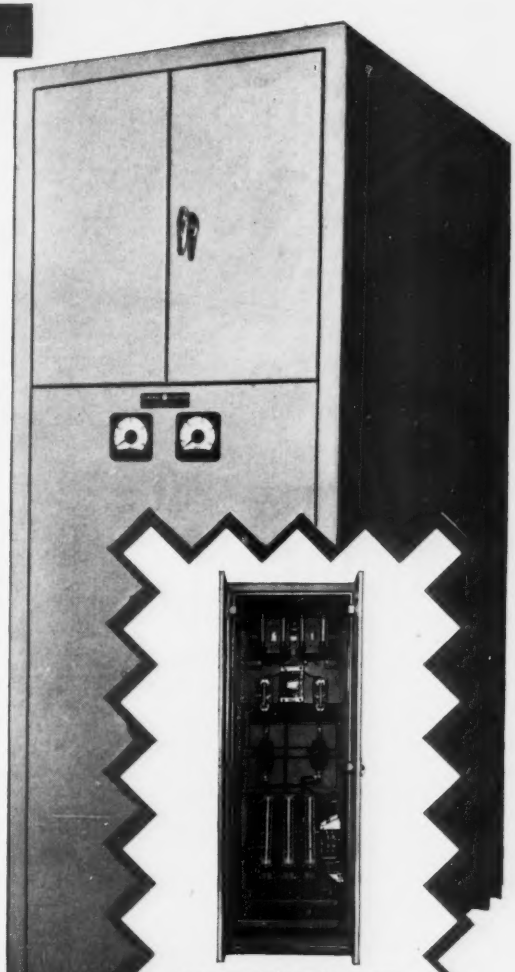

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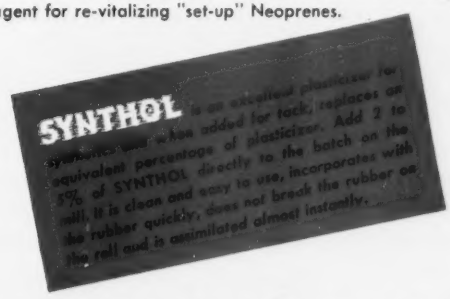
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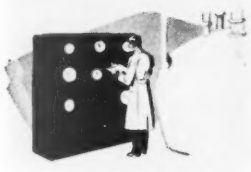

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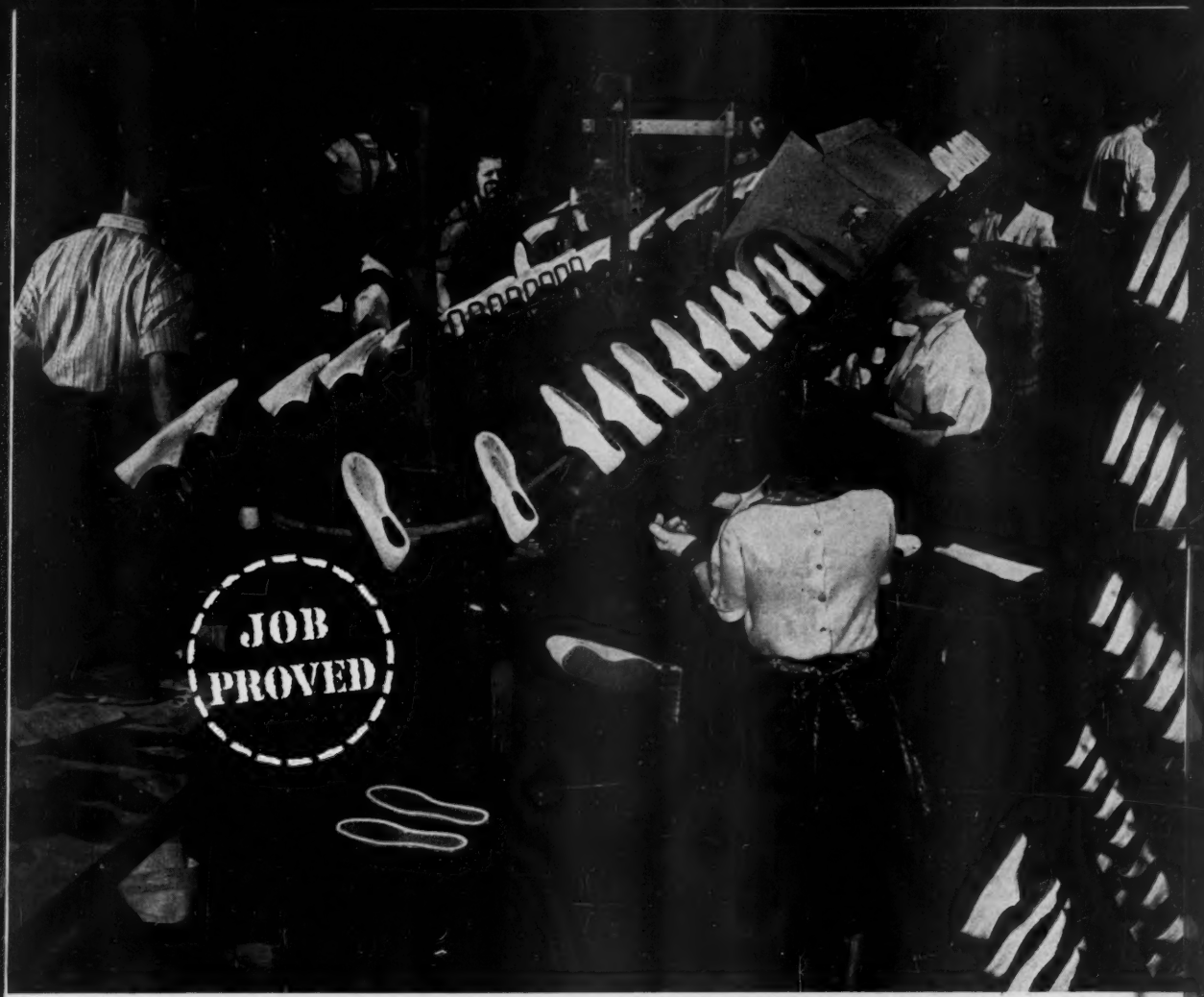

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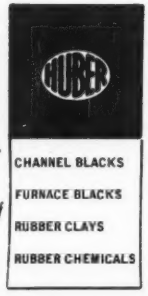

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RUBBER AGE

Vol. 67, No. 6 SEPTEMBER, 1950

Uses of Flame Sprayed Polysulfide Coatings and New Methods of Application

By ELLIOTT A. BUKZIN

Senior Materials Engineer, Elastomer Section, Bureau of Ships, Navy Department, Washington, D. C.

The following data on the flame spraying of polysulfide coatings (of the Thiokol type) represents some more of the excellent work being performed by the rubber personnel of the Bureau of Ships of the Navy Department. The author, Mr. Bukzin, has been associated with the Elastomer Section for many years, working under the direction of T. A. Werkenthin, principal materials engineer of the section.—Editor.

CORROSION problems have been associated with the merchant marine and navies of the world since steel ships were initially constructed, almost a century ago. With increased speeds, erosion or cavitation problems on certain underwater areas have been even more of a problem. Erosion has caused such severe pitting and loss of metal of propeller shaft struts and rudders as to require their complete replacement. Figure 1 is a typical main propeller strut of a destroyer showing the type of pitting involved. This discussion is based on the action taken by the Bureau of Ships to overcome these problems on our Naval vessels.

It was recognized early in the development of protective techniques for propeller struts and rudders that waster zincs for anodic protection in way of the bronze

FIG. 1—Typical main propeller strut of a destroyer showing the type of pitting involved.

Note: The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval service at large.

FIG. 2—This view indicates how an early application of thermoplastic polysulfide rubber has worn away from one of the struts of an aircraft carrier after only six months of service.

propeller was not the complete answer to erosion failures. It was also recognized that if rubber could be applied to these areas and vulcanized in place with the necessary heat and pressure, the pitting and rusting of these appendages would essentially be eliminated. This recognition was based on the use of rubber for numerous industrial applications in pipe and tank linings as well as the successful application and service rendered on rubber covered propulsion shafting since the early days of the *S.S. Leviathan.*

Natural rubber and subsequent synthetic rubber covering of shafts was limited to these shaft sections located in the stern tube of the ship, aft of the stuffing box where maintenance was impossible without pulling lengths of shafting as much as 66 feet long and 24 inches in diameter. Exposed shafting, known as intermediate and tail shafting, was maintained by standard bottom painting procedures until recently. Recently it became obvious that corrosion cracks in way of the bronze water lubricated bearing journals were becoming so prevalent as to seriously affect the potential operation of the fleet. Steps have been taken, within budget limitations, to remove steel corrosion or waster rings in way of the bronze journals in order to examine for and repair shaft cracks. Subsequently, the corrosion rings are not replaced but exposed steel surfaces are completely covered with rubber.

When time and funds permit, sheet rubber is applied in accordance with either Navy Department Specifications 33R6 or 33R7 for solid and hollow shafts, respectively. Otherwise, a relatively new brush-on neoprene cement and putty system may be used. Flame sprayed polysulfide rubber is used as an alternate material. The latter is preferred at present for applications made right in the dry dock since it takes less time and initial set up costs are less. Since a good proportion of shafts examined require shop repairs, the neoprene cement system is becoming more popular.

Curing unvulcanized sheet rubber to massive steel sections such as struts and rudders in dry docks was abandoned early in the program for reasons obvious to the rubber technologist, since considerable heat and pressure is required to obtain a satisfactory bond to the steel and a complete cure of the sheet rubber. The application of the neoprene cement type coating mentioned above has not been widely used largely because

FIG. 3—Intact appearance of a properly applied coating after 18 months' operation on a twin screw destroyer strut.

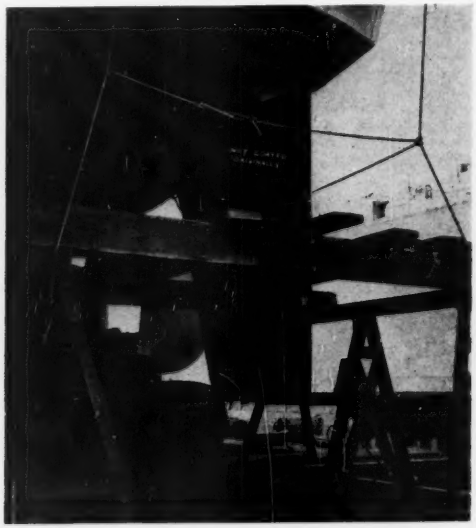


FIG. 4—For proper surface preparation the pits must be peaned or plug welded and then chipped and ground smooth.

it is difficult to control the rate of heating required to cure the material on these large appendages without removing the solvent too quickly. This may result in porosity which provides subsequent passage for water entry.

To return to the advent of flame spray equipment, the development of flame spraying of organic materials followed similar applications of powdered metals.* This technique offered a means of overcoming the objections of curing at sustained elevated temperatures as well as those associated with solvent base coatings. Flame spraying of powdered hard rubber resulted in a rather inflexible coating but several plastic type materials showed promise. Powdered polysulfide synthetic rubber, or Thiokol AP as it was known, appeared to offer the most promise since the metal surface temperature at which satisfactory application could be made was about 170° F. This temperature can be readily attained by blow torches, electric strip heaters, or steam bled into hollow rudders. The powdered polysulfide softens to an almost molten state when projected through the flame of the gun and yet when it impinges on a vertical surface, it does not sag.

Early application of thermoplastic polysulfide rubber to propeller shafts and struts showed that the material was not sufficiently rubberlike to provide the protection desired for much more than six to nine months except on relatively slow ships. Figure 2 shows how this material has worn away from one of the struts on an aircraft carrier after only six months of service. It was relatively brittle and inflexible as well as evil smelling and expensive. It was too thermoplastic in nature, but by active research it was found that it could be cured into a rubberlike substance rather than one having the appearance and consistency of a hornlike material.

The addition of small amounts of lead peroxide and acetanilide during the powder grinding operations provided the cure desired after flame spraying. This cure resulted in a coating having a minimum tensile strength and ultimate elongation of 500 pounds per square inch and 150 per cent, respectively. These strength and elongation values are in themselves not high for rubber coatings but when the material is applied properly, its adhesion to steel is such as to be as great as or greater than the cohesion of the material itself. This property is believed by many to be essential for long service life where the hydrodynamic forces are extremely severe. It largely precludes stripping away of the coating after a break may have been initiated by mechanical or service damage. This stripping action is an objection observed on films having much higher tensile strengths.

* Goldberg, B., *Product Engineering*, Oct., 1941.

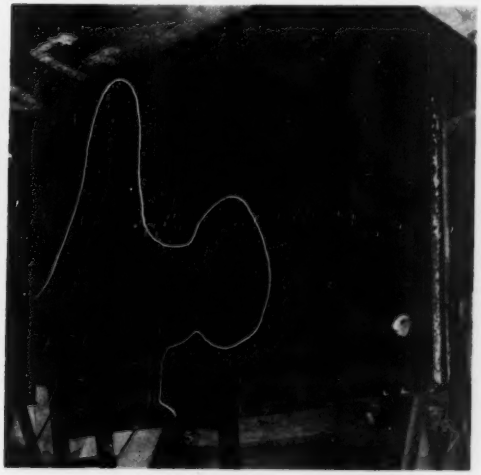


FIG. 5—As a rule, patching results in almost complete homogeneity with the previously coated areas.

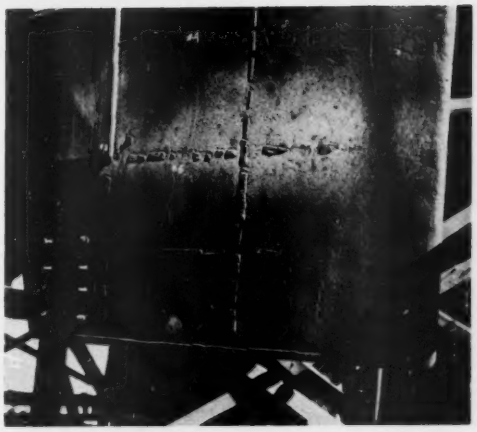


FIG. 6—If surface preparation is of the type indicated in this view, the coating may carry away in a matter of days or weeks.

Flame sprayed polysulfide rubber has proven itself more than adequate for protecting propeller struts and rudders of all classes of Naval vessels. Figure 3 shows the intact appearance of a properly applied coating after 18 months' operation on a twin screw destroyer strut. The one exception is indicated on such twin screw DD692 Class destroyers having rudders directly aft of the propellers. These rudders pit badly and have on occasion completely fallen apart in very short periods of time when not protected.

The successful use of this protective coating in such severe service is directly dependent on the pains taken with surface preparation of the type that will reduce irregularities of water flow, as shown in Figure 4. Namely, the pits must be peaned or plug welded and then chipped and ground smooth. Rudder inspection plates, where welded on, should leave as streamlined a surface as is practicable. Such surface preparation would be unnecessary, of course, for the initial application on a new ship. However, few ships had this material applied when they were new. Furthermore, directives require that the coating not be applied unless evidence is present of pitting and corrosion above normal. The word "normal," of course, connotes different things to different people. The same is true for this work.

At the Puget Sound Naval Shipyards, the coating was and is being applied to every vessel docked for overhaul within the time limitations that exist. Care is taken to prepare the surface and later check for pinholes with high frequency-high voltage spark tests. Each applicator must be qualified by the expert technicians in the Shipyard Material Laboratory before he is permitted to undertake production work.

The life of a properly applied coating will, of course, depend upon the severity of the service to which it is

subjected. To reiterate, the most severe service is the application to DD692 Class destroyer rudders. Here, even though the coating is not intact at normal overhaul periods of 18 to 20 months, the metal is so mildly affected as to require but light sandblasting before patching with the coating material. Such patching, incidentally, results in almost complete homogeneity with the previously coated areas, as indicated in Figure 5. On the other hand, if surface preparation is of the type shown in Figure 6 even after application, the coating may carry away in a matter of a few days or weeks.

The Navy is quite conservative in certain respects and requires the use of zincs as a secondary precaution against electrolytic action in addition to coating the surfaces. The zincs are bolted onto studs welded to the surfaces of the rudders and struts. They loosen up and often carry away in a short time, particularly when attached to the rudders of high speed ships. The loosened zincs chafe the coating and also expose the studs to corrosion failures when they carry away. This is demonstrated in Figure 7. The breakdown of these studs is so complete at times, that they result in holes in the rudder plates.

The application of flame sprayed polysulfide rubber has, until about a year ago, been largely limited to Schori pistols. Their operation has rarely been entirely satisfactory except when operated by a highly skilled technician. Modifications made to the guns and dispensers by local activities to improve their ease of operation have reduced some of the problems of clogging and intermittent flame bursts which the operation is subject to. Loss of material passing through the flame usually amounts to between 40 and 50 per cent, depending on the amount of fines in the powder. About a year ago, the "Bondwell" gun became available. Its operation, which depends on a pressure powder feed as compared with the vacuum feed of the former, has proved to be almost trouble free and reduces the time of operation as much as 50 per cent. The losses through the flame are about the same, however.

Powdered polysulfide rubber is purchased at about $1.40 per pound. A thickness between 0.025 and 0.050-inch is required to provide a pinhole free coating. A good operator can apply between 10 and 15 square feet of coating per hour. The cost therefore is quite high and is limited in use to those areas where these costs are of a secondary consideration.

The high costs of this material and its application have long been recognized. Numerous research and development projects have been undertaken in the past to develop a rubberlike coating which could be applied using standard painting practices and no special heat curing conditions. To date, nothing that will meet these conditions and the performance tests specified in Navy Department Specification 52-C-24 has been offered. Flame sprayed polysulfide rubber, odors and all, therefore continues to be applied where its cost and application difficulties are more than offset by the protection it provides to essential underwater steel surfaces subjected to severe corrosion and cavitation phenomena.

FIG. 7—Loosened zincs frequently chafe the coating and also expose the studs to corrosion failure, as indicated in this view.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to the Bureau of Ships, Department of the Navy, for permission to publish the information contained in this paper. He particularly wishes to acknowledge the immeasurable assistance he received from personnel in industry and in the various Naval establishments from whom the data and information were assembled over the past several years. The list of those who actively participated and contributed includes Captains W. C. Latrobe and W. A. Hickey, Commander H. H. Fox, Jr., Lieutenant Commander O. H. Landua, Mr. T. A. Werkenthin, Miss E. Levene and Mr. E. F. Greenleaf of the Research Division of the Bureau of Ships; Mr. R. E. Morris, of the Mare Island Naval Shipyard; Mr. C. K. Chatten of the New York Naval Shipyard; and Dr. W. B. Lew of the Puget Sound Naval Shipyard.

Workable Plastisols Made with Polymeric Plasticizer

ALTHOUGH polymeric plasticizers contribute desirable permanence to vinyl compounds, their high viscosity has sometimes limited their use in plastisols. Recent laboratory work indicates, however, that vinyl plastisols of readily workable, stable viscosity can be prepared from the newest of the Paraplex G-series plasticizers, G-60.

Laboratories of the Resinous Products Division of the Rohm & Haas Company tested plastisols containing Paraplex G-60. Batches of various sizes were prepared, and viscosity was measured at the outset and after aging one, seven, and 28 days. The initial viscosity of the batches was low—comparable with that of batches prepared with phthalate plasticizers included in the test. The thixotropy of the G-60 batches was extremely low. No significant change in the initial viscosity of 24,000 centipoises occurred during aging.

Films cast from the plastisols were extremely resistant to loss of plasticizer by volatility or by water extraction. In retaining good color despite prolonged exposure to 250°F., the films corroborated growing reports that G-60 exerts an uncommon stabilizing effect on compounds exposed to heat in processing or service.

Paraplex G-60 is said to combine plasticizing efficiency, light color and clarity, and compatibility with solution grade vinyls. In chlorinated hydrocarbons, chlorinated rubber and nitrocellulose, G-60 acts as a combination stabilizer and plasticizer.

Success of Cuba's Largest Rubber Factory Credited to Efficient American Methods

ONE of the leading foreign plants affiliated with the B. F. Goodrich Company is Compania Goodrich Cubana, which started production of rubber products on the outskirts of Havana, Cuba, in 1942, and is now the largest rubber plant in the Caribbean area. The Cuban organization, in which B. F. Goodrich holds a minority interest, bought the site of an old tire plant located 15 minutes by auto from downtown Havana, and with technical assistance from the American company built a modern plant that uses the same efficient production methods employed in the United States.

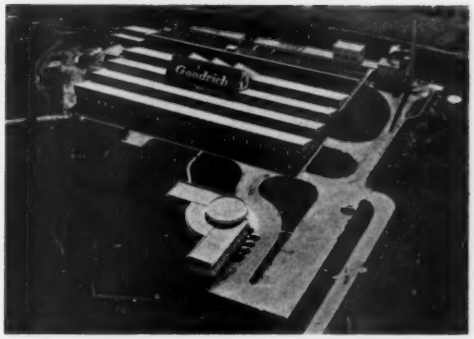
The company completed a modern one-story building in 1946 to house its executive and sales offices. At that time CGC held a reception and open house that was widely attended by several hundred Cuban government officials, leading members of the diplomatic corps, and local club officials. A specially-prepared souvenir booklet was distributed and each guest was shown through the rubber plant.

Three of the top supervisory posts—general manager, factory manager and technical superintendent—are filled by Americans, while all other employees are Cuban. C. M. Stewart, general manager, says the number of automobiles in Cuba has more than doubled from 45,000 in 1945 to nearly 100,000 vehicles in 1950.

In addition to tires and tubes, the plant produces camelback, extrusions such as Koroseal hose, cements, tank lining, and all types of molded goods. The company maintains a technical service department to assist customers and has developed many special rubber products for the island's giant sugar industry.

Employees are allowed three days' sick leave per month with pay, with a maximum of nine days in a year. A company doctor makes a spot check of employees who do not report for work in an effort to discover chronic offenders.

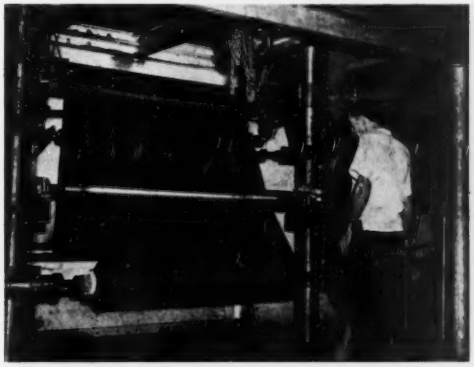
Many excellent employee relations programs used in Goodrich plants in the United States have been adopted by the Cuban affiliate. Pins are awarded to long-term employees. A suggestion system is used with excellent results. The company also stresses a plant-wide safety program that has been successful. An employee communications pipeline is maintained by a factory bulletin that is distributed weekly in time-card boxes.



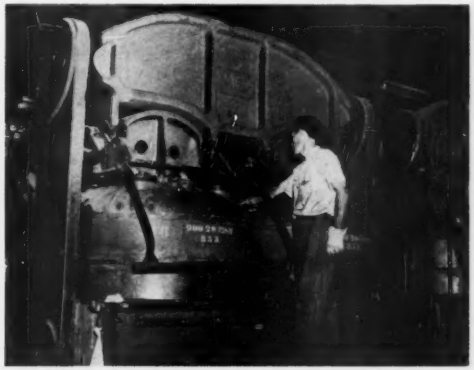
Aerial view of the modern plant of Compania Goodrich Cubana, 15 minutes from downtown Havana.

CGC purchases its natural rubber directly from the Far East. It buys butyl rubber in the United States for its tubes. The company uses rayon cord produced in Cuba and also features the famous B. F. Goodrich "Rythm Ride" construction in tires.

Although labor's wage rate has increased 360 per cent since 1942 and raw materials also have advanced sharply, Compania Goodrich Cubana is optimistic about the future and feels that the record number of automobiles and the current level of island prosperity will result in continued high demand for rubber products.



One of the Cuban employees watching rayon cord fabric on the take-up roll after it has been dipped in rubber for tire use.



Twelve Akron-built tire molds are in use at the Cuban plant. Shown here is a large double mold unit built by McNeil Machine.

Low-Temperature Potentialities of the Silicone Rubbers

A RECENT investigation at the National Bureau of Standards in Washington, D. C., under the joint sponsorship of the Office of Naval Research and the Quartermaster Corps has shown that the silicone rubbers, developed especially for high-temperature applications, have better potentialities for use at extremely low temperatures than any synthetic or natural rubber studied thus far. This conclusion is based primarily on measurements of the second-order transition temperature of the silicone rubbers by C. E. Weir, W. H. Leser, and L. A. Wood of the Bureau staff.

The silicones are synthetic rubbers in which some of the carbon atoms normally present are replaced by silicon and oxygen. Since these materials are highly resistant to heat, retaining their elasticity and electrical resistance at temperatures as high as 200°C. (400°F.), they have been found especially well suited for hose and gaskets in airplane engines and for insulated cables. In recent years a need has also arisen for a type of rubber capable of withstanding low temperatures without loss of its characteristic rubber-like properties.

Tires, belting, or other articles of ordinary rubber lose their elasticity around —50°C. (—60°F.), presenting many difficulties in connection with the operation of motor vehicles and machinery in the arctic or of airplanes at great height. To learn more about the possibilities of using the silicones for such low-temperature applications, the National Bureau of Standards undertook an investigation to determine the lower limit of the temperature range in which they retain their characteristic elasticity.

This lower limit was determined by locating the second-order transition temperature, a temperature at which a marked change in the slope of the length-temperature curve occurs. Such a change is observed in all rubbers and plastics and can be recognized as a discontinuity in the derivatives of volume, heat content, index of refraction, compressibility, dielectric constant, and other quantities with respect to temperature. A order transition, or change of phase, in that no volume second-order transition differs from the ordinary first-change or latent heat is involved. However, below the second-order transition temperature the type of molecular motion responsible for the useful properties of a rubber ceases, and the material behaves essentially as an ordinary solid.

In practice a rubber becomes useless for applications requiring long-range elasticity at temperatures somewhat higher than the transition temperature, the exact amount of the difference depending on the particular application. Thus, in natural rubber the second-order transition temperature is at —70°C. (—94°F.), but the rubber is seldom useful below about —55°C. (—67°F.).

Determination of Thermal Expansion

In the Bureau's investigation, the necessary thermal expansion measurements were made in an interferometer. Small slabs of rubber were placed between the two quartz interferometer plates. Then, as the temperature of the interferometer was changed, the rubber slabs contracted or expanded, changing the distance between the plates and causing the interference fringes to the eyepiece to move relative to a fixed point of reference. The temperature of the specimens was recorded, and the number of fringes passing the reference point was counted as the temperature was varied slowly from —196°C. (—321° F.), the boiling point of liquid nitrogen, to 100°C. (212°F.).

Several Silicone Rubbers Studied

The silicone rubbers studied were all of commercial origin, and all except two, which were pure-gum silicones, contained fillers and vulcanizing agents. Several of the samples were especially designed for low-temperature applications. As only small differences in transition temperature were observed among any of these samples, it was concluded that fillers and vulcanizing agents have little effect on the second-order transition temperature. Additional measurements on two commercial silicone rubbers not designed for low temperatures were in substantial agreement with those for the low-temperature silicones.

One variety of low-temperature silicone rubber was outstanding in that its expansion curve was essentially linear from 100°C. (212°F.) until the second-order transition temperature of approximately —123°C. (—189°F.) was reached. Below this temperature a much lower coefficient of thermal expansion, more nearly like that of a rigid solid, was observed. All other silicone rubbers studied likewise exhibited a second-order transition at approximately —123°C., the lowest temperature at which such a transition has been observed in a polymeric material. However, the other silicones, on being cooled from room temperature, also went through a first-order transition at temperatures varying from —65°C. (—85°F.) to —75°C. (—103°F.).

The first-order transition was observed experimentally as the very rapid passage of a large number of fringes past the reference point while the temperature was varied over a narrow range. This effect was interpreted as corresponding to a considerable decrease in volume associated with partial crystallization of the amorphous silicone. The crystallization process produces some stiffening and has apparently prevented the successful use of silicone rubbers below this temperature. However, the one variety which exhibited no first-order transition should have good possibilities for use at temperatures as low as —100°C. (—148°F.).

On heating the partially crystalline material, melting was found to occur over a range of temperatures considerably higher than those required to produce crystallization. This behavior is analogous to that shown by natural rubber. The volume change of the pure-gum silicone rubber on crystallization or melting varied over a range from 2.0 to 7.8 percent. Between 0°C. and —35°C., the expansivity of the pure material was about 40 x 10^{-5}/deg C. Similar data were obtained for the silicones containing fillers and vulcanizing agents, but the values obtained were lower because of the presence of these ingredients.

Basic Effects of Wood Cellulose as a Filler in Rubber

By PAUL M. GOODLOE, D. H. McMURTRIE, and R. J. VAN NOSTRAND

Brown Company, 500 Fifth Ave., New York 18, N. Y.

ALTHOUGH the use of pure, finely divided cellulose in rubber compounding has already been reported,* a brief statement of the origin and physical appearance of the cellulose products in question will be an aid to understanding the experimental data covered in this report. Such products are derived by the chemical reduction of northern spruce and birch woods to isolate the alpha cellulose which they contain, and the conversion of this cellulose to products of controlled fiber length. In this way, white or brown materials of the desired bulkiness or free flowing characteristics are obtained.

For the present study a choice was made of two typical items which represent (1) the bulkiest, longest fibered product which is also readily dispersible in rubber compounds, namely, 40 mesh alpha cellulose (Solka-Floc BW 40), and (2) the shortest fibered, finest cellulose powder which is commercially available, namely, 100 mesh alpha cellulose (Solka-Floc BW 200). This report gives data obtained in comparing these two cellulose products (at equal volume loadings in both GR-S and smoked sheet) with a black (Pelletex), a clay (Suprex), and a hydrated calcium silicate (Silene EF). The test formulas employed were as follows:

	A	B
GR-S	100.0	—
Smoked Sheet	—	100.0
Zinc Oxide	3.0	5.0
Stearic Acid	1.0	2.0
Altax	1.5	1.0
Tuads	0.2	0.15
Sulfur	2.25	2.25
Filler	Vols. as indicated	

Compound A was cured in 30 minutes at 320° F. and Compound B was cured in 15 minutes at 287° F., except when Suprex was used as a filler, when a 30 minute cure was used, and for Pelletex, when a 10 minute cure was used. All compounding was conducted on a two-roll laboratory mill by an independent commercial testing laboratory. No special treatment was employed for the dispersion of the various fillers, and proper results were obtained with all of the fillers without resort to either masterbatching or refining. All tests reported were made at room temperature on unaged stocks and at optimum time of cure.

The following code is utilized in Figures 2 to 11 covering the five fillers used in these tests:

A—Solka-Floc BW-40
B—Solka-Floc BW-200
C—Silene EF
D—Suprex Clay
E—Pelletex

* Goodloe, Paul M., Reding, T. L., and McMurtrie, D. H., Wood Cellulose in Rubber Compounding, *Rubber Age (N.Y.)*, Vol. 61, pp. 697-703 (Sept., 1947).

Experimental Observations and Conclusions

The acceptance of finely divided wood cellulose by the rubber industry has been predicated on two things: (1) At low percentages it reduces shrinkage, kills nerve and serves as a processing aid; (2) At moderate loadings it contributes firmness and builds dimensional stability into the compound.

In neither case does it exhibit appreciable effect on the rate of cure. This is shown in Figure 1, where tensile strength is plotted against time of cure, and the shape of the curve for each type of elastomer is the same regardless of particle size or total amount of cellulose employed. This is particularly evident in the case of the GR-S data where it happened that most of the curves coincided.

It will also be observed from the data in Figure 1 that cellulose, when used alone, does not produce GR-S stocks of typical tensile values. In natural rubber, however, adequate tensiles are obtained and stocks filled with cellulose only are in commercial production in the drug specialties field.

The effect of wood cellulose on shrinkage is shown in Figure 2. It is greatest in these gum stocks or those of relatively low loadings, although significant reductions may also be obtained in compounds which are heavily loaded with other fillers. The effect is also apparent in connection with shrinkage occurring during curing, particularly in the case of oven curing of calendered footwear. Because wood cellulose is effective in killing nerve and overcoming shrinkage, its use contributes to the production of smoother calendered sur-

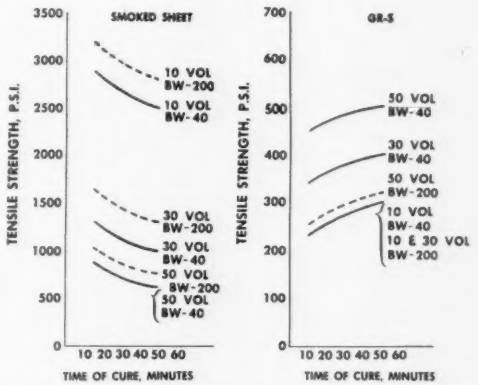


FIG. 1—Effect of purified wood cellulose on rate of cure.

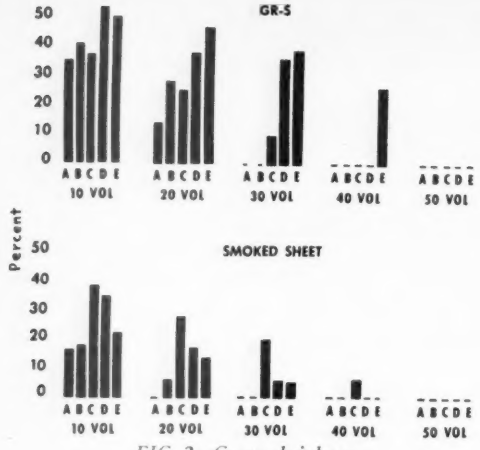


FIG. 2—Green shrinkage.

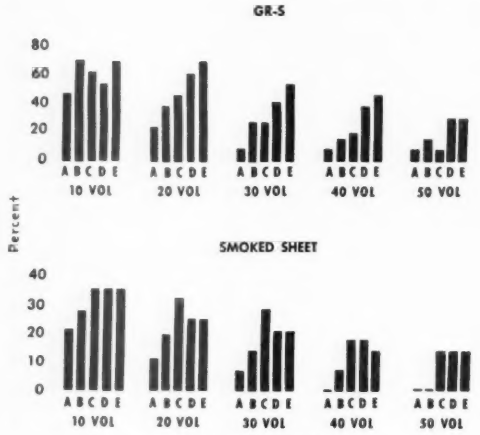


FIG. 3—Tuber swell.

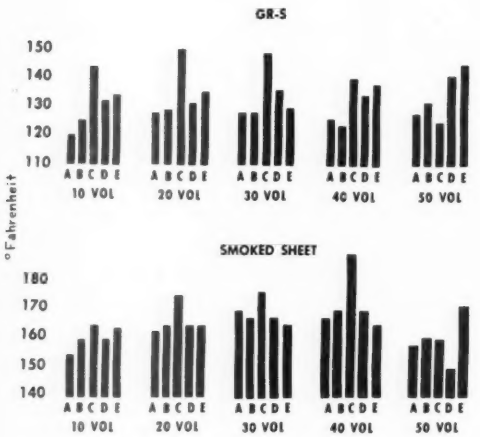


FIG. 4—Batch temperatures.

faces of all types. In floor tile both harder and smoother surfaces are obtained at the same time that processing is made easier.

Reduced shrinkage should, in turn, show up in reduced tuber swell and that this is so is exemplified in Figure 3. Use of finely divided wood cellulose makes it possible to control tuber swelling or even to eliminate it entirely with reproduction of the true dimensions of the die. Its concurrent effect in lowering the required processing temperatures (Figure 4) for comparative hardness levels of cured products means that such cellulose stocks will extrude at higher rates, or with less power and less tendency to scorch.

The relatively low power consumption of cellulose containing stocks is demonstrated in Figure 5, particularly when this data is weighed with regard to cured durometer hardness. Corresponding high time of scorch is shown in Figure 6 and plasticity results in Figure 7. In the latter case, it appears that cellulose in rubber stocks modifies a normal balance between elastic and plastic phases with resulting greater plasticity, while maintaining or increasing hardness of cured goods.

Wood cellulose is the most effective of the various fillers for producing increased durometer hardness at low and medium percentages (Figure 8). Because of this, its use is usually on the basis of replacing an equal or greater volume of other filler so that the final hardness level will not be excessive. Perhaps because of the lower volume loading required, use of finely divided wood cellulose to gain a given hardness level produces stocks of greater resilience and flex life than is generally the case with other similar non-blacks.

While the true specific gravity of alpha cellulose is 1.58, its use in loaded rubber compounds indicates a working specific gravity of 1.3 to 1.4. This is of importance in producing low gravity and light weight products which are sold and used by the square foot or square yard. For example, a natural rubber stock can be taken to about 60 hardness with alpha cellulose while maintaining a specific gravity of only 1.05. This characteristic of cellulose used as a non-black filler is typified by the data in Figure 9.

Aside from the low specific gravity of cellulose in rubber compounds, it contributes remarkable increases in durometer hardness with surprisingly low corresponding increases in modulus. This minor effect on modulus, along with the fact that cellulose is not reinforcing with regard to tensile strength, is shown in Figure 10, where the open bars represent tensile measurements and the filled represent the corresponding 300% moduli.

The absence of brittleness in cellulose filled rubber compounds is of significance when considered in connection with the corresponding elongation values (Figure 11). Thus, finely divided wood cellulose is commercially practical for overcoming "rubbery" characteristics and producing end products with plastics-like properties, such as soling, tiling, matting, wheels, toys, upholstery and artificial leather, etc.

Some Applications of Cellulose Flock

To illustrate the wide adaptability of high alpha cellulose flock in rubber compounding, brief mention will be made of its established uses in a variety of specific end products.

Soles, Top Lifts, etc.: Cellulose is widely used in the production of non-spreading, hard flexible soles and like products and Solka-Floc is considered among the best for economy and quality of finished products. It contributes the necessary dimensional stability and desirable appear-

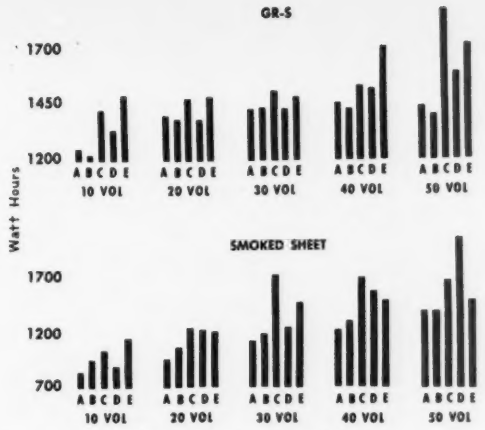


FIG. 5—Power consumption.

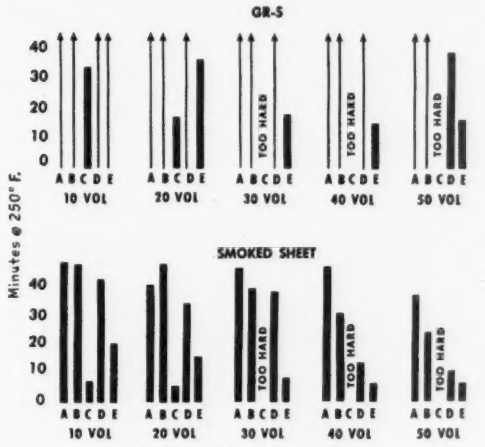


FIG. 6—Mooney scorch.

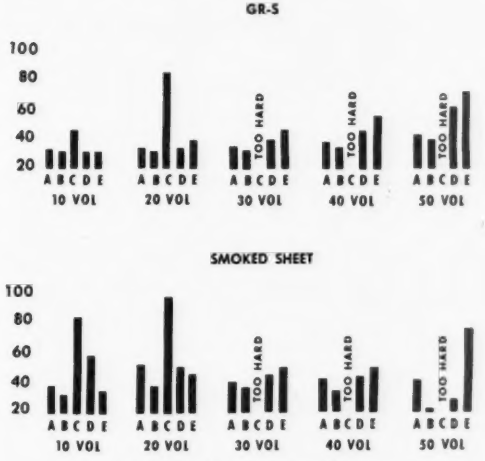


FIG. 7—Mooney plasticity.

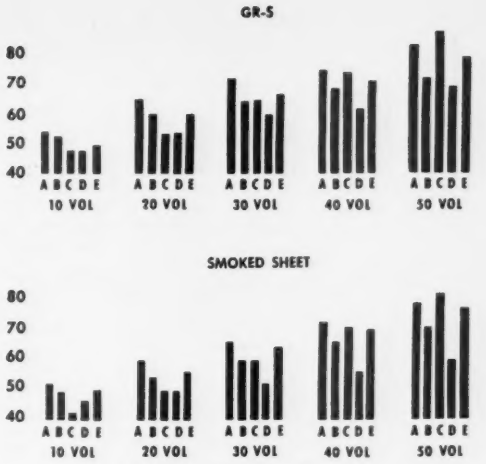


FIG. 8—Shore hardness.

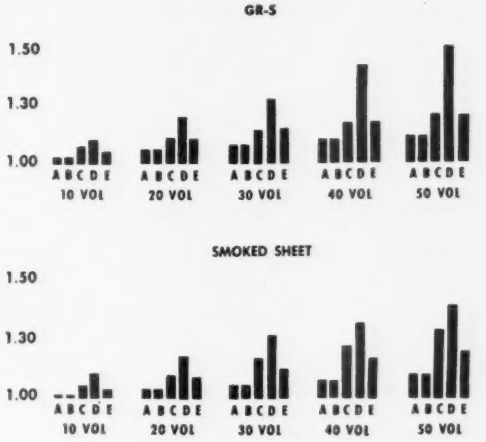


FIG. 9—Specific gravity.

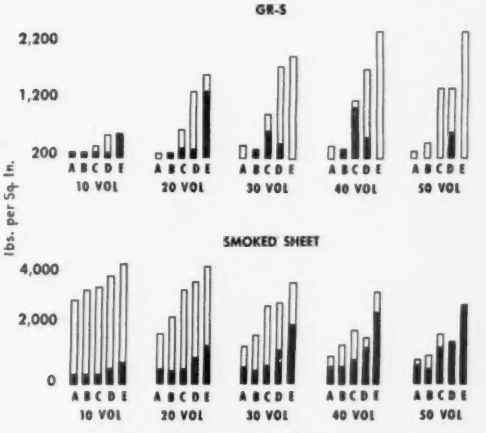


FIG. 10—Tensile strength and 300% modulus.

ance while maintaining exceptional ease of processing. It is dispersed without resort to masterbatching and refining.

Calendered Footwear: In the production of calendered footwear, where a shoe is built up by cementing, excessive shrinkage during oven curing may result in rupture of seams and high rejections. In such cases, the addition of 5 to 10 parts of Solka-Floc to the base stock will control the cured shrinkage at the necessary operating level.

Floor Tile: Solka-Floc is used in floor tile stocks to give good processability and colorability while contributing high surface hardness and resistance to indentation and good indentation recovery. These highly loaded and tough processing stocks are handled better and easier by replacing 20 to 50 volumes of other filler with Solka-Floc to reduce power requirements, tendency to scorch, blistering, etc., and to obtain smoother, hard surfaces, and sharper mottled designs.

Matting and Tread: These are made lighter in weight and given the proper "dead" or "boardy" feel through the use of about 20 parts of Solka-Floc.

Proofed Goods: Incorporation of Solka-Floc in the rubber cements used for wet spreading leads to production of proofed goods of better hand and free from excessive rubbery feel.

Molded Goods: Cured shrinkage in molded goods is frequently taken into account in the design of the mold; however, the lower the degree of shrinkage, the easier it is to accurately control this variable. The use of Solka-Floc to lower shrinkage has proved to be efficient and practical.

Extruded Goods: Use of Solka-Floc at 10 to 20 parts gives cooler running stocks that more accurately hold the dimensions of the die and give smoother surfaces. The contribution of the cellulose to the unworked firmness of the prevulcanizate helps overcome collapsing, sagging, etc.

Sponge: Small amounts of Solka-Floc are used in blown sponge to obtain more uniform cell structure. Larger amounts give a firmer sponge for platforms, closures, etc.

Foamed Rubber: The total solids content of latex for foaming is being adjusted upward to a predetermined constant level through the addition of light weight and

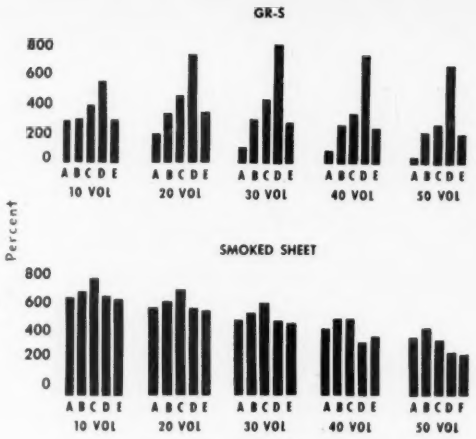


FIG. 11—Elongation.

finely divided Solka-Floc. Specially coated cellulose can be used at high percentages.

Drug Sundries: Solka-Floc is used as a compounding ingredient when non-toxic, light-colored hardness and stiffness is required.

Air Bags: Use of some 10 parts of Solka-Floc in air bag stocks results in longer life because of a reduced rate of growth.

Rolls and Tank Liners: To give these products maximum hardness and maximum resilience (lack of brittleness), 30 to 40 or more parts of Solka-Floc are combined with other fillers.

Records: Solka-Floc is used in records both for economy and for its ease of wettability and consequent smoother mixes.

Latex Adhesives: Finely divided Solka-Floc dispersed as filler in latex enables production of adhesives with non-shrinking film characteristics and improved sealing efficiency.

Gotham Convertible Recorder

Recording temperatures and pressures under a variety of changing conditions is said to be easily accomplished with a new 6-inch chart recorder manufactured by Gotham Instruments, Division of American Machine & Metals, Inc., 149 Wooster St., New York 12, N. Y. The unit is only 8⅜ by 10⅝ by 3¾ inches in size and weighs only 7½ pounds, not including the tubing. Temperature and pressure systems of this recorder are interchangeable so that at any time the instrument may be converted from a temperature to a pressure recorder or vice versa, or changed in range of temperatures or pressures recorded. The temperature system ranges cover from —40° to 1,000° F.; pressure system ranges from 0 to 5,000 psi. The bulb of the instrument is supplied with mercury, gas or vapor filling according to use. The mounting brackets furnished are reversible so that the recorder may be flush or wall mounted. Legs and handle, though not standard equipment, are also available to make the recorder portable and self-standing.

Sarco Steam Circulation System

A new type of steam circulation system which is said to considerably improve the efficiency of such steam-heated equipment as platen presses, heaters for drying machines, and tubular heaters of stills and evaporators, has been developed by the Sarco Co., Inc., 350 Fifth Ave., New York 1, N.Y. According to Sarco engineers, the flow of steam and condensate in the steam spaces of equipment of the type mentioned is naturally sluggish, thereby causing a reduction in the rate of heat transfer. The Sarco system is said to create a turbulent flow of the steam and condensate, resulting in an even surface temperature and an improved rate of heat transfer. The Sarco Steam Circulation System consists of a Sarco float trap and a Sarco circulator. The circulator is actually an injector which uses the uncondensed steam to induce turbulence in the flow of condensate. Use of the system is reported to result in substantial savings of steam.

Division of Rubber Chemistry, A. C. S. to Hold International Meeting in Cleveland

THE 57th Meeting of the Division of Rubber Chemistry, American Chemical Society, will be held in Cleveland, Ohio, on October 11 to 13. This will be an International Meeting, with forty to fifty delegates from foreign countries attending, many of whom are scheduled to deliver papers. Included will be delegates representing the British Rubber Producers' Research Association, Rubber Research Institute of Malaya, Institut Francais du Caoutchouc, Rubber Foundation of Holland, and several other research organizations. Well over 1,000 chemists are expected to attend.

The meeting will feature the presentation of 46 technical papers, a luncheon-meeting of the 25-Year Club, presentation of the Goodyear Lecture by Dr. C. C. Davis of the Boston Woven Hose & Rubber Co., the regular business session, the annual suppliers' cocktail party, and the divisional banquet. On the Monday and Tuesday following the meeting a plant tour will be conducted through the major rubber factories in nearby Akron. This tour, sponsored by the Akron rubber companies, will be for the special benefit of the foreign chemists.

Headquarters at Hotel Cleveland

Headquarters for the Division will be the Hotel Cleveland, and all technical sessions will be held at that hotel. Because of the extensive program planned, it has been found necessary to hold two concurrent technical sessions. These double sessions will be held on Thursday afternoon, October 12, and Friday morning, October 13. The technical sessions will be held in the Grand Ballroom of the hotel and in the Red Room, which is adjacent to the ballroom. Papers have been so scheduled that those to be given simultaneously will conflict as little as possible in general interest. The first session is scheduled to begin at 10:00 A.M. on Wednesday, October 11.

The luncheon-meeting of the Division's 25-Year Club will be held at noon on Wednesday, October 11, with Dr. R. P. Dinsmore, vice-president of the Goodyear Tire & Rubber Co., presiding as chairman. Both the suppliers' cocktail party and the divisional banquet will be held at the Hotel Carter, with the cocktail party scheduled to start at 5:00 P.M. on Thursday, October 12, and the banquet two hours later. Presentation of the Charles Goodyear Medal and speeches by world leaders in the rubber industry will highlight the banquet. The Goodyear Lecture, by Dr. Davis, will be given during the technical session on Thursday morning, October 12, and will be followed by the business meeting of the Division.

Registration, Tickets, Banquet

No pre-registration has been arranged for the meeting, but registration facilities will be available on the mezzanine floor of the Hotel Cleveland starting at 8:00 A.M. on Wednesday, October 11. Tickets for the divisional banquet, however, can be secured in advance at a cost of $6.50 each by addressing requests and remittances to F. A. Bonstedt, c/o Sid Richardson Carbon Co., Evans Bank Building, Akron 8, Ohio. There is, of course, no charge of any kind for attendance at the suppliers' cocktail party.

Amos W. Oakleaf (Phillips Petroleum) is general chairman of the Local Arrangements Committee with Cecil A. Smith (N. J. Zinc) as vice-chairman. The general committee includes the following: *Banquet*, F. A. Bonstedt (Sid Richardson Carbon); *Advisory*, C. W. Christensen (Monsanto Chemical); *Meeting Rooms*, Wm. von Fisher (Case Institute); *Foreign Liaison*, C. A. Hemingway (Witco Chemical); *Registration*, E. H. Krismann (DuPont); *Treasurer*, Henry F. Palmer; *Publicity*, Ralph F. Wolf (Columbia Chemical). Jack Hamilton (Binney & Smith) is chairman of the Suppliers' Cocktail Party, with Allyn I. Brandt (Goodrich Chemical) acting as local chairman in charge.

Titles, authors and abstracts of the 46 technical papers scheduled for presentation at the meeting follow herewith:

Program of the
DIVISION OF RUBBER CHEMISTRY
AMERICAN CHEMICAL SOCIETY
Hotel Cleveland, Cleveland, Ohio
October 11-13, 1950

Wednesday Morning—October 11

10:00 A.M.—Introductory Remarks by Dr. F. W. Stavely (Firestone), Division Chairman.
10:10 A.M.—Technical Papers.
12:00 Noon—25-Year Club Luncheon.

Wednesday Afternoon—October 11

2:00 P.M.—Technical Papers.

Thursday Morning—October 12

9:00 A.M.—Technical Papers.
11:00 A.M.—Goodyear Lecture, by C. C. Davis (Boston Woven Hose & Rubber Co.).
11:30 A.M.—Business Meeting.

Thursday Afternoon—October 12

2:00 P.M.—Technical Papers (Note: Two Concurrent Sessions Will Be Held).

Thursday Evening—October 12

5:00 P.M.—Annual Suppliers' Cocktail Party, Ballroom, Hotel Carter.
7:00 P.M.—Divisional Banquet, Rainbow Room, Hotel Carter.

Friday Morning—October 13

9:00 A.M.—Technical Papers. (Note: Two Concurrent Sessions Will Be Held).

Friday Afternoon—October 13

2:00 P.M.—Technical Papers.

ABSTRACTS OF PAPERS

Wednesday Morning—October 11

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

10:10 A.M.—Vulcanization Characteristics of N,N'-Dithioamines in Furnace Black Stocks. *M. C. Throdahl and M. W. Harman (Monsanto Chemical Co., Nitro, West Va.).*

The recent adoption of high modulus and high abrasion furnace blacks for reinforcement of natural and synthetic rubber stocks has led to increased scorch problems during mixing and processing. A partial solution of this scorch problem is effected by use of well-known sulfenamide accelerators and sulfur. However, still further progress in the reduction of scorch in stocks containing high modulus and high abrasion furnace blacks has been achieved by replacement of the usual free sulfur with certain organic compounds of the N,N'-dithioamine class.

N,N'-dithioamines are a class of organic compounds which contain the nucleus >N-S-S-N<. Those N,N'-dithioamines reported in this paper were prepared by reacting sulfur monochloride with the appropriate secondary amines possessing alkyl, cyanoalkyl, alkyl-aryl, cycloalkyl, and heterocyclic groups.

In general, many N,N'-dithioamines delay the scorch time over free sulfur two- to three-fold at processing temperatures of 135° C. (275° F.) and yet give equally high modulus and tensile values at curing temperatures 8 to 10° C. higher. Evidence exists which indicates that the N,N'-dithioamines do not just "liberate" sulfur at vulcanizing temperatures, for the total sulfur content of rubber stocks containing them is usually less than half that required to obtain equivalent cured physical properties when using free sulfur. The most effective N,N'-dithioamines also impart improved aging and flexing characteristics to rubber stocks containing furnace blacks.

Data demonstrating the scorch and vulcanizing characteristics, aging and flexing properties are given for a series of N,N'-dithioamines in different rubber stocks. The syntheses of a number of these new N,N'-dithioamines are described.

10:40 A. M.—The Bonding of Butyl Rubber to Brass. *R. W. Kaercher (American Can Co., Maywood, Ill.) and G. W. Blum (Case Institute of Technology, Cleveland, Ohio).*

An investigation of some factors important in the adhesion of butyl type synthetic rubber to a series of brass compositions is presented. A testing method for the evaluation of comparative bonding strength is shown, based upon the pounds per square inch of tensile pull, normal to the plane of bonding, required to rupture the bond. Brass sheets of nominally 95, 90, 85, and 70% copper were employed, with the balance essentially zinc. The brass disks employed for bonding had one square inch of bonding surface, and were bonded by sandwiching a sheet of uncured butyl rubber between two disks; the butyl formation used throughout the investigation was a representative inner tube stock. The brass disks were resurfaced for reuse following each experimental determination. The rubber was cured between flat platens without a die, air cooled, and conditioned for twenty-four hours at 70° F. and 40% relative humidity prior to testing the strength of adhesion. The strength test, made at a constant rate of crosshead travel of 0.025-inch per minute, required approximately one minute to obtain rupture of the bond.

The influence of methods of surface preparation, pickling conditions, and surface contamination upon the various brass compositions are shown graphically. The experimental data obtained emphasize the essential need for uniform surface preparation. Polishing with flour of emery, followed by pickling in the acid bath, produced the highest consistent bond strengths. Accompanying photomicrographs illustrate various degrees of surface uniformity, as well as the non-uniform attack of the acid on the machined surface when the preliminary polishing is eliminated. A pickling composition of equal parts of sulfuric acid, nitric acid, and water to which 0.2% of HCl has been added, gave a bright surface suitable for bonding, when used for 10 seconds at 50° C. An induction effect limiting the efficiency of a new acid mixture was noted; the addition of 10% of a previously used bath acid to 90% of new acid mixtures resulted in considerably higher bond strength. Optimum conditions for curing the butyl rubber were found to be 30 minutes at 325° F., with conditions of undercure deleterious to the bond strength. Investigation of curing pressures from 1000 to 5000 psi showed a critical range of 1500 psi to 2000 psi for maximum bonding.

The copper content of the brass had a very marked effect upon the bonding. Brass containing 70% copper is superior for bonding over the widest range of conditions, while the 85% copper content brass was bonded successfully only when the pickling time was doubled to 20 seconds. Pickling of the 70% copper content brass at this 20 second period resulted in a badly spotted surface effect and lowered bonding strength. Brass containing 90% and 95% copper never yielded a bond strength exceeding 250 psi, even under longer pickling conditions, in comparison with the strengths obtained for 70% brass exceeding 1000 psi. The surface contamination caused by exposure to air is shown to be an important factor in maximum bonding strength. The 70% copper content brass was found to be the least critical, with a period of 45 minutes of air exposure maximum before a serious decrease in bond strength was shown. The higher copper content brasses were more readily contaminated by air oxidation, and a much lower time of exposure is permissible for them.

Despite the unique chemical nature of butyl rubber, the strength of adhesion of butyl rubber to brass was found to be governed by many of the basic factors previously reported for the bonding of other types of rubber.

11:00 A. M.—Aging of Black Neoprene Jackets. *G. N. Vacca, R. H. Erickson, and C. V. Lundberg (Bell Telephone Laboratories, Murray Hill, N. J.).*

A prime consideration in the choice of materials for outdoor telephone wire is long service life. In the course of development of neoprene compounds for this purpose, therefore, resistance to aging was made an object of special study. As part of this program samples of experimental wires were returned from the field at intervals for observation. It was noted that while there was little change in tensile strength with time, elongation decreased fairly rapidly. It was evident that before much confidence could be placed in these materials for long term use, more complete information on their aging characteristics was necessary. A supplementary program of accelerated testing was therefore undertaken to provide data for correlation with outdoor studies.

Air oven aging tests at temperatures from 70 to 150° C. indicated in each case a fairly rapid decrease in elongation in the early stages of the aging periods, followed by a slower rate of change over comparatively long periods. Data are presented which indicate that loss of elongation follows the same general curve in all cases. Additional samples from the field representing up to nine years of outdoor exposure gave results corroborating those obtained in the oven aging tests in that the drastic loss of the first few years was followed by a much more gradual loss of elongation in later years.

This rapid loss of elongation in the early stages of aging appears to result in part from a continuation of the polymerization and cross-linking processes which were responsible for the original cure. Further loss of elongation results from oxidative effects on the neoprene molecules. This is indicated by a comparison of the effects of heating a neoprene compound in the presence of air and with air excluded. At 150° C., there is a loss of 20% of the original elongation in approximately two hours regardless of presence or absence of air. Continued heating in air then reduces elongation to less than 10% of original in 30 hours whereas with air excluded, heating for 144 hours reduces elongation to approximately 50% of original.

These data on neoprene were compared with similar aging characteristics of black GR-I, GR-S, GR-A, and natural rubber compounds. After 24 days at 100° C. it was found that the GR-I compound had leveled off at 50% of original elongation and that there had been little change in the last 12 days of the aging period. The other compounds ranged from 5 to 20% of original elongation at the end of the 24 day period and the natural rubber compound was poorest in this respect.

Effect of the aging on brittleness temperature was also determined. It was found that even with elongation reduced to less than 20% of original, brittleness temperature of the neoprene compound was raised only 8 degrees. The GR-S and GR-I showed a small change and were comparable with neoprene while GR-A and natural rubber showed considerable change.

The effect of the aging on the insulation underlying the neoprene jacket was also studied. In this case, the insulation was a black GR-S compound and tests were limited to compression

resistance since the insulation was bonded to the conductor. Compression resistance was increased as would be expected and it was found that the compound was not brittle but was still satisfactory insulation.

The work reported in this paper shows that early loss of considerable elongation of a neoprene jacket compound is not necessarily indicative of short service life and that its resistance to heating and oxidation effects of outdoor exposure is such that it can be expected to last at least twenty years.

11:25 A.M.—The Effect of Synthetic Elastomers on the Properties of Petroleum Asphalts. *H. A. Endres, R. J. Coleman, R. M. Pierson, and E. A. Sinclair (Goodyear Tire and Rubber Co., Akron, Ohio).*

During the 1930's the members of the Dutch Rubber Foundation under R. Houwink and J. M. Van Rooyen evaluated extensively the effect of small amounts of natural rubber powder on the properties of asphalts, and carried the program to the point of laying sizable road test installations. This work is being actively followed up by both the Dutch and British. Since the war, investigation of synthetic elastomers of the GR-S type for the same purpose has been initiated in this country, as reported by R. P. Dinsmore and G. M. Sprowls.

At present the Goodyear research laboratory is making an examination of the different variables that enter into the preparation of a suitable elastomer powder for use in road type asphalts. These variables can be divided into two categories: (1) those related to the nature and composition of the elastomer, i.e., the polymerization variables, and (2) those pertaining to physical methods of processing the polymer into a powder form. The present study is concerned primarily with the former.

Properties which the rubber powder additives are designed to influence are softening point, penetration, and useful temperature range. The authors have found that the addition of 5 to 10% of synthetic elastomers increases softening point, decreases penetration and improves low temperature properties, and that the extent of the changes is quite critically dependent on the elastomer composition. Since particle size of the powder profoundly affects ease of dispersion and rate of attainment of equilibrium, care must be taken to distinguish between effects due to the polymer itself and to its physical state.

The small scale evaluation procedure used has consisted of preparation of polymers as latex in 4 oz. or 5 gal. polymerization vessels, spray coagulating the latex in the form of a fine particle size slurry, and handling the powders during washing, screening and drying by methods which maintain the small particle size without cohesion. Although a number of additives and procedures have been investigated to "detackify" the particle surfaces, the standard procedure for this study has been to incorporate additional soaps. The dried powders are incorporated into the mix by slowly trickling them into the stirred asphalt at 300° F., samples being withdrawn after various heating times. Typical road-type petroleum asphalts have been used. Because of the small amounts of polymer employed and the insensitive nature of the tests, only rather gross effects can be detected.

Among polymerization variables which have been studied to date are monomer composition (chiefly butadiene and styrene), molecular weight and sol-gel properties, conversion, and reaction temperature. Of these, monomer composition and sol-gel relationships have been found to have most pronounced effects. Over a wide range of butadiene/styrene ratios, increasing butadiene content results in improvements in all of the properties tested, polybutadiene being slightly better than GR-S. In the investigation of molecular weight and sol-gel properties, the two extremes in this category represented by vulcanized rubber on the one hand and a soft over-modified soluble polymer on the other are both poor in comparison to polymers which are intermediate in these properties, particularly those prepared so that the polymer has just reached or passed its "gel point," i.e., contain sol of a maximum molecular weight and gel of a very loose character. Polymers containing this latter type of gel impart gel-like properties to the hot asphalt which are reflected in its flow properties. Conversion and polymerization temperature have been observed to exert only minor effects.

Synthetic elastomers of optimum properties have been found to equal, and in some respects excel, natural rubber powders. Reclaim powders have been found to have little effect on properties. The observed effects are discussed briefly in the light of currently advanced theories of the mechanism.

Highway engineers have recognized the deficiencies of asphalt in road construction, particularly its temperature susceptibility, and will welcome means of correcting these. The use of rubber in asphalt compositions for other purposes also shows promise.

Wednesday Afternoon—October 11

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

2:00 P. M.—Influence of Particle Size on Creaming of Rubber Latex by Means of Ammonium Alginate. *E. Schmidt and R. H. Kelsey (Firestone Tire & Rubber Co., Akron, Ohio).*

The creaming properties of Hevea and GR-S latices under the influence of ammonium alginate were studied as a function of particle size. A set of GR-S samples which differed only in particle size was prepared by treating a small particle size latex with a critical amount of sodium chloride for varying periods of time. After the particle growth had been arrested by further dilution, the highly diluted latices of different particle sizes were creamed with various quantities of ammonium alginate. The amount of creaming agent required for creaming decreased drastically with increasing particle size of the latex.

Varying the stability of the latex (by reducing the electrokinetic potential with salt, or increasing the particle charge by soap addition) without change of particle size had practically no effect on the creaming properties of the latex.

It was shown that a Hevea latex containing a wide range of particle sizes could be separated into fractions, each of which contained any desired range of particle sizes, by successive creaming operations, with incremental additions of ammonium alginate.

A correlation between particle sizes of three dilute colloidal systems (GR-S latex, Hevea latex, silica hydrosol) and the concentration of ammonium alginate required for creaming was observed. This correlation held over a wide range of particle sizes (200 to 9000 A. U. in diameter).

Fractions of a Hevea latex, of different particle sizes, obtained by fractional creaming were examined with respect to viscosity and to cream concentration. The maximum cream concentration increased as the particle size was increased, and the viscosity of the concentrates, adjusted to the same rubber and creaming agent concentration, diminished as the particle size was increased.

2:25 P. M.—Direct Reinforcement of Natural Rubber Latex Mixture. *J. Le Bras and I. Piccini (Institut Francais du Caoutchouc, Paris, France).*

The possibilities of reinforcing rubber directly by mixing latex with synthetic resins in order to obtain results comparable with the reinforcement of masticated dry rubber with carbon black have been investigated.

Among other resins, some water-soluble resins of the "resorcinol-methanol (formaldehyde)" type, the conditions of preparation and the degree of condensation of which have been determined, give to the natural rubber vulcanizates exceptional mechanical properties, superior to those of the best mixes made of dry rubber and reinforcing carbon blacks.

The polycondensation of the resin is initiated before its addition to the latex and goes on *in situ* afterwards. The resin is introduced into a latex which has been heat sensitized by means of trypsin and which also contains the usual vulcanization ingredients, i.e., sulfur, zinc oxide and accelerator. The latex-resin mixture is gelled in hot water at 70° C. within ten minutes after mixing and is then dried and vulcanized in hot air.

Zinc diethyldithiocarbamate gives good vulcanization in hot air at temperatures between 80° C. and 100° C. and cadmium diethyldithiocarbamate is particularly suitable at temperatures between 100° C. and 120° C.

Both hardness and modulus of latex-resin vulcanizates increase with increase in the molecular ratio methanol/resorcinol, M/R, whereas elongation at break undergoes only small variation. Furthermore, tensile strength at break, tear and abrasion resistance pass simultaneously through a maximum for a value of the M/R ratio of 1.

The optimum amount of liquid resin to be used is about 10 gms. per 100 gms. of latex of 60% total solids content. All the properties of such a vulcanizate containing 10% of resin with

an M/R ratio of 1 are quite remarkable. Tensile strength at break is about 470 kgs./cm.² compared to about 329 kgs./cm.² for the best carbon black-dry rubber mixes. Tear resistance values of more than 100 kgs./cm² have been obtained using the ASTM method.

Permanent set and flex resistance are as good as for the control latex mix without resin. For the latex-resin mix, resistance to solvents is improved and dielectric properties and heat conductivity are better than those of a dry rubber-carbon black mix of the same hardness. Manufactured articles have a bluish-black color due to the oxidation of the resorcinol; their aging, however, is excellent.

2:40 P. M.—The Influence of Soaps on the Gelling Characteristics of Hevea Latices. *D. J. McKeand (Dunlop Rubber Co., Ltd., London, England).*

Previous contributions to the study of the gelling of concentrated Hevea latex by delayed action coagulants such as sodium silicofluoride have attempted primarily to explain the fact that gelling takes place on the alkaline side of neutrality. This paper discusses further work on the mechanism of gelling with sodium silicofluoride carried out with the intention of interpreting the gelling mechanism from the point of view of changes in particle protection, in particular of soap, as the pH falls.

The change in surface tension with pH for centrifuged latex serum was studied and compared with similar relationships measured for soaps, such as castor oil soap, potassium oleate and potassium laurate. In each case a minimum was shown to exist at or near the normal gelling pH of centrifuged latex, i.e., pH approximately 8.0. Potentiometric titrations of these soaps showed that this minimum coincided with the hydrolysis of soap ions to acid soap. Measurements were also made on the above soaps of the change with pH of the interfacial tension against xylene. The results obtained indicate that the hydrolysis of the protective soap layer in a centrifuged ammonia-preserved latex has a considerable bearing on the pH of gelling.

The investigation was extended to a latex of different particle protection, namely that preserved with Santobrite and 0.1% ammonia. Here high mechanical stability is coupled with poor gelling characteristics. The addition of castor oil soap was found not only to raise the pH of gelling slightly but also to turn the paste-like gel into one which was very much firmer.

In order to determine the influence of Santobrite on the stability of latex, additions of Santobrite were made to an ammonia-preserved latex when the mechanical stability increased by an amount almost proportional to the quantity added, thus indicating that the enhanced stability of this type of latex is largely due to Santobrite itself.

It was appreciated that if the Santobrite could be neutralized as a protective agent then more normal gelling characteristics might be realized. Accordingly, cationic soaps were added and it was found that a firm gel was obtained at a pH of approximately 8.0. Parallel tests on the mechanical stability were carried out which showed a marked and almost proportional drop in stability with increasing concentration of cationic soap.

Similar tests were made using soaps of non-ionic type, when it was found that although these also caused a similar marked decrease in stability, there was no corresponding improvement in gelling characteristics.

The theoretical implications of the foregoing experimental observations have been considered.

3:05 P. M.—The Zinc Oxide Stability of Latex. *Dr. G. E. Van Gils (Stichting Indonesisch Instituut voor Rubberonderzoek, Bogor, Indonesia). (Note: Dr. G. J. van der Bie will present this paper).*

The "stability" of latex is a very complex and not yet fully defined phenomenon. It varies with the origin, season, and other circumstances. Before the problem can be answered as to the way these factors are of influence, we have first to draw a clearer picture of what is meant by stability. In this paper we will restrict ourselves to the zinc oxide (ZnO) stability, a feature which is most important for the latex technology.

As a measure for the ZnO stability the KOH number is generally accepted. Although there may be a correlation between ZnO stability and KOH number in many cases, we object strongly to accepting the KOH number as a sole specification for the quality of the latex. We agree, that as latex ages, for instance, the KOH number as well as the ZnO stability alters gradually. We also found that when the preservation of latex is delayed the KOH number rises and the ZnO stability drops; but when figures of latex of different origin and different treatment are compared in most cases no correlation can be found. For these reasons we advocate the measurement of the ZnO stability as well, which can be done either by measuring the time of coagulation on heating with a fixed amount of ammonium salt or by measuring the increase in viscosity.

Coming to the discussion of the factors which influence the ZnO stability, we must make a formal distinction between intrinsic factors and additional factors.

INTRINSIC FACTORS

1. Age of latex: The older the latex the lower the ZnO stability. Artificial aging can be carried out by means of enzymes. This subject has already been investigated thoroughly by our French colleagues.

2. Composition of the latex: The influence of amino acids is already known (degradation); during storage acidic constituents are formed which form salts with the ammonia present and so give rise to a higher concentration of ammonium ions. In this way the correlation between KOH number and ZnO stability can be explained. A new factor recently discovered by this laboratory is the influence of the quebrachitol concentration on the ZnO stability.

3. DRC of latex: The higher the DRC the lower the ZnO stability.

4. Yellow fraction: The higher the yellow fraction content the better the ZnO stability.

ADDITIONAL FACTORS

Surface active agents of the type of fatty acid- or sulfonic acid-soaps have no influence or only in higher concentrations. Neither are active proteins such as casein, gelatin, globulin, and pepton. From the non-ionic detergents we found that Emulphor O increases the ZnO stability whereas Vulcastab LW is only active in higher concentrations. The sequestering agents (Sequestrene AA) are active if their coagulating effect on latex is nullified by the addition of a stabilizer which is not active as such. Very useful stabilizers are the phosphates, with the exception of Calgon (hexameta phosphate) which is only slightly active. The ZnO stability is further increased by sodium silicate and sodium hydroxide.

Of the substances which lower the ZnO stability the ammonium salts only are mentioned. Investigations have been carried out with HCl salts of amines, of which some appear to be active. Although the investigations are not yet completed we have discovered a substance which promises to become of technical importance for the heat sensitization of latex and for foam rubber manufacture.

3:25 P. M.—Absorption of Oxygen by Ammonia-Preserved Latex. *J. McGavack and E. M. Bevilacqua (United States Rubber Co., Passaic, N. J.).*

A number of experimental findings that have been accumulated over the past twenty years concerning the absorption of oxygen by Hevea latex are described. The details show the experimental methods used and also the rate of oxygen absorption due to bacterial invasion, to agitation in itself or agitation during storage of the latex, to the effect of pH, to the age of the latex, to temperature and pressure, to the introduction of oxidizing agents, and record the changes in the physical properties of the latex, such as stability and viscosity, as well as the resultant effects on the rubber and vulcanizates prepared from latex exposed to oxygen. The data also show that the addition of less than 0.2 of one per cent of oxygen on the total solids of the latex lowers the Mooney value from 110 to 40 with indications of still lower viscosities with further addition of oxygen.

Absorption due to bacterial invasion of the latex can be quantitatively titrated as carboxyl while only a very small proportion of the oxygen can be thus accounted for when a sterile latex is oxidized.

The net result of the work indicates that it is extremely important that a user or seller of latex should clearly understand to what measure his material has been exposed to oxygen. The text is supported by tabular data and graphs.

3:50 P. M.—The Kinetics of Cyclization of Hevea Latex. *M. Gordon (Dunlop Rubber Co., Ltd., London, England).*

According to a process discovered in 1947, dispersions of Hevea latex particles in a medium of 70 to 80% H_2SO_4 are smoothly and reproducibly isomerized to a high molecular weight, cyclized rubber. The process, which depends on the addition of H_2SO_4 to concentrated latex containing suitable stabilizers, is technologically useful and has been patented. It is also suitable for a kinetic investigation of the cyclization reaction.

A detailed procedure has been worked out for controlling and checking the composition of the acid latices. A technique has been developed for measuring the density of the purified polymer after exposing it to cyclization for varying times. This technique uses an improved density gradient tube. Unimolecular constants varying over four powers of ten are obtained and vary enormously with percentage c of H_2SO_4 and the absolute temperature T thus:

$$\log_{10} K = 6 + 0.17c - 7105/T.$$

The activation energy E is of the order of 33 Kcals. and appears independent of acid concentration. The measured frequency factors vary between $10^{10.2}$ and $10^{19.2}$ mins.$^{-1}$ between c = 72.6 and 78.5%.

Application of a statistical theory by Flory shows that 13.5% of the isoprene units originally present in rubber are left uncyclized by the reaction. This result is in striking agreement with unsaturation analyses of cyclized rubber made by H. L. Fisher in 1927. The kinetic effect due to the survival of uncyclized units is negligible at a first approximation.

The rate measurements correlate satisfactorily with Hammett's acidity function H_0 over a range of acidities not previously covered kinetically. The reaction is rate controlled chemically and not by diffusion. The method of making rate measurements on stabilized emulsions in strong H_2SO_4 is accordingly of general promise, particularly in the terpene field. A carbonium ion mechanism for rubber cyclization is supported by the present measurements and the rate control attributed to a mobile protonation pre-equilibrium and a slow deprotonation step. The high activation entropy is accounted for by the charge neutralization during deprotonation. The proton affinity of rubber, i.e., the acidity constant of the base rubber (an important chemical constant), is estimated to be of the order —8 to —10.

A critical discussion is attempted of the comparison between the cyclization of rubber and that of other terpenes. Physical and chemical properties, and mechanistic analysis, support the structure for cyclized rubber given by D'Ianni and co-workers apart from a statistical correction.

4:15 P. M.—On the Presence of an Esterase in Latex of Hevea Brasiliensis. *L. N. S. De Haan-Homans (Stichting Indonesisch Instituut Voor Rubberonderzoek, Bogor, Indonesia).*

Up to now no mention appears in the literature of the presence of an esterase in latex of Hevea brasiliensis, but the presence of a lipase has been proved in the seeds of the plant and in the latices of various other plants, particularly Euphorbiaceae.

An investigation of the occurrence of a lipase or an esterase in latex of Hevea brasiliensis was started during the Japanese occupation of Java, when Van Gils and Altman developed a theory that a fat splitting enzyme might be involved in the process of the spontaneous coagulation of latex. This investigation was interrupted in 1944, was taken up again later, and terminated recently for the time being.

The search for a lipase had no distinct positive result. Ricinus oil and a fatty substance isolated from the latex were not affected when emulsified in the latex itself or in any preparation made from latex. (Note: The preparations from latex included the yellow fraction of the latex and serum obtained by freezing latex or yellow fraction. As latex and its preparations are good emulsifiers, sufficient emulsification was obtained by shaking the mixtures vigorously by hand in small, glass-stoppered Erlenmeyer flasks for three minutes). Arachis oil was split only to a very slight extent and monobutyrin only a little more. However, when using a low ester as butyl-, ethyl- or methylbutyrate, amylacetate, and especially ethylacetate, a distant esterase activity was proved. As in so many other respects, the case of enzyme activity latex is very variable.

The following percentages of splitting up of the substrates in suitable emulsions were found after 24 hours of incubation at 37° C.; at the start of the experiments the pH was about 8.5, this being about the optimum pH of the enzyme:

butyl butyrate	8.0 - 13.8%
ethyl butyrate	3.3 - 6.3%
methyl butyrate	12.6 - 13.5%
amyl acetate	7.6 - 29.1%
ethyl acetate	24.6 - 59.0%

No mention has been made in the literature of the presence of a low ester in latex. However, we have been informed verbally by K. C. Sekar of the Rubber Research Institute of Malaya that he has found that the volatile acids formed in putrefying latex consists for the most part of acetic acid. Further investigations at the INIRO have shown that the pH of the latex decreases rapidly; this starts immediately after the latex has exuded from the tree, so that no bacterial action can be involved. It is possible that the newly found esterase plays a role in the formation of these acids; its special affection for acetates should be in accordance with Sekar's findings of acetic acid in putrefying latex.

The enzyme may be purified by addition of 2 parts of 96% alcohol to the serum or by addition of ammonium sulfate followed by filtering off of the proteins from the precipitates and dissolving them in water.

Thursday Morning—October 12

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

9:00 A. M.—Determination of the Molecular Structure of Rubbers by Physical Methods. *L. Nielsen, R. Buchdahl, and G. Claver (Monsanto Chemical Co., Springfield, Mass.).*

Physical methods such as dynamic mechanical tests and infrared spectroscopy are powerful tools for determining the chemical and molecular structure of synthetic rubbers. Dynamic shear moduli and mechanical damping were determined over a temperature range for a series of styrene-butadiene rubbers in which the ratio of the starting monomers as well as the polymerization conditions were varied. The dynamic properties were determined with a recording torsion pendulum of a new design; a brief description of the instrument is given. All the rubbers show a transition range where the material changes from a rubber to a rigid solid and the damping goes through a maximum. The temperature of maximum damping is primarily a function of the ratio of styrene to butadiene in the copolymer, but changes in the polymerization conditions also bring about some shifts in this temperature. The width or broadness of the damping temperature peak depends quite strongly on the polymerization variables. The width of this peak depends upon the heterogeneity of the rubber on a molecular scale. In the case of extreme heterogeneity more than one damping peak has been observed. The effect of regulators in this connection is illustrated.

Evidence is presented which indicates that if it were possible to produce a pure butadiene rubber in which there were no crystallinity and no crosslinking, such a material should remain a rubber down to about —140° C.

Infrared spectroscopy brings out structural details on a scale even smaller than do the dynamic mechanical tests. As other investigators have shown, the infrared spectra will indicate the relative amounts of cis-trans isomerism and 1-2 or 1-4 addition in the polymers. Infrared absorption curves have been made on a series of rubbers in order to correlate if possible the spectra with the mechanical properties and the swelling properties in benzene.

9:25 A. M.—Influence of Fillers on the Elastic Modulus and Swelling of Butyl Networks. *R. L. Zapp (Esso Laboratories, Standard Oil Development Co., Linden, N. J.) and E. Guth (University of Notre Dame, Notre Dame, Ind.).*

The reinforcement of elastomeric vulcanizates by filler particles has been studied with a polymer of limited unsaturation such as commercial butyl rubber. The limited unsaturation insures a comparison of filler reinforcement in materials of constant concentration of chemical cross links, for an excess of curing agents over and above that required for reaction at all points of unsaturation can be added without increasing the state

of cure beyond a definite point. Under such conditions differences in the adsorption powers of fillers will not result in variation in the ultimate state of vulcanization.

Reinforcement in this paper was defined as the ability of a pigment to enhance the elastic or equilibrium stress (at constant elongation) of a vulcanized specimen. Equilibrium stress at 50% elongation was determined on a triple beam balance and the components of stress, internal energy and entropy contributions were differentiated. When just the entropy contribution to stress was considered such values adhered more closely to the classical viscosity analog equation for reinforcement where only the volume concentration of filler and not the surface area is the controlling factor. It was observed that carbon blacks, especially the finer varieties, possessed a greater internal energy contribution to stress than did mineral fillers. The increase in stress upon the addition of mineral fillers was due in great part to entropy contributions.

Another manifestation of reinforcement was shown to be the restriction of volume swelling of a network (in a good solvent) by the addition of pigments. Carbon blacks showed the greatest restriction of swelling capacity, and contrary to stress observation this restriction was related to the total surface area of carbon black added to the rubber compound. With mineral fillers, far less restriction was observed and in some cases an increase in swelling was noted. This can be attributed to poor bonding which results in voids. The photomicrograph of clay particles in a thin stretched section of butyl shows this effect in Figure 21 of the paper to be presented. The role of surface forces in the case of carbon blacks has been further demonstrated in a study of the elastic properties of swollen rubbers. The reinforcing nature of carbon black is maintained in a swollen network while the weak bonds between a polymer and a mineral filler are destroyed when the chains are spread apart by the imbibed solvent, and the stress is similar to an unloaded compound.

9:55 A. M.—Some Optical Examinations of Anisotropy in Vulcanizates. *Stefano Oberto (Pirelli Societa per Azioni, Milan, Italy).*

The anisotropic behavior of vulcanizates as revealed by differences in modulus, breaking load and tear, swelling in solvents, and electrical properties, according to the direction of test, is well known. Anisotropy is attributed both to a state of tension in the rubber phase only, and to a preferential orientation of the elongated particles of certain fillers. As regards anisotropy due to processing, such as calendering and extruding, it has recently been recognized that anisotropy due to movement of the stock in the mold during the first phase of vulcanization is even of greater importance.

By submitting spew, slabs, sheets and test pieces to examination under transmitted polarized light, it is relatively easy to obtain optical evidence of the presence therein of anisotropy caused by movements during molding operations. The localization of the movements may be such as to make it desirable to examine with a microscope at low magnification microtome sections, 50 microns thick, of the vulcanizates. For this purpose a transparent gum compound can be used, but more details can be seen if a small quantity (1%) of carbon black is added.

The transparent compound may be used, always under polarized light, for the direct examination of samples a few millimeters thick—or better, of sections of equal thickness taken from products of different dimensions. The examination is particularly interesting in the case of injection molded products, in which case it is possible to tell from the variations of double refraction when molding conditions favor scorching before the rubber has come to rest.

If a certain quantity of talc, or some other ingredient with elongated strong double-refractive particles, be introduced into the transparent compound, it is possible to observe the orientation of the particles caused by the processing or molding flow. In a calendered sheet, for instance, the talc particles lie almost parallel to each other, but towards the center of the sheet the orientation may be less marked or may occur along slightly different directions. In injection molding, too, the talc clearly reveals flow direction and anisotropy.

Under optical observation, which may be effected in restricted areas, the difficulty of obtaining rubber products, particularly test pieces, which are entirely isotropic is confirmed. Almost pure gum compounds have been examined, but the anisotropy found will probably assume even greater importance in loaded mixings, especially those loaded with carbon black.

10:15 A. M.—The Inflation of a Rubber Diaphragm. *J. E. Adkins and R. S. Rivlin (British Rubber Producers' Research Association, Herts, England).*

In the theory of large elastic deformations of incompressible highly elastic materials, which are isotropic in their undeformed state, the elastic properties of the materials are expressed in terms of a stored-energy function W (the energy stored elastically in unit volume of the deformed material) which must be a function of the principal extension ratios λ_1, λ_2, and λ_3 defining the amount of deformation. It has, in fact, been shown that W must be a function of quantities I_1 and I_2 which are themselves functions of λ_1, λ_2, and λ_3 defined by

$$I_1 = \lambda_1^2 + \lambda_2^2 + \lambda_3^2 \text{ and } I_2 = \frac{1}{\lambda_1^2} + \frac{1}{\lambda_2^2} + \frac{1}{\lambda_3^2}$$

The form of the functional relationship between W and I_1 and I_2 for a pure gum vulcanizate has been found from a number of experiments carried out on test pieces of the material subjected to very simple types of deformation such as simple extension, pure shear, simple torsion, etc.

It has been found that within the accuracy of the experiments W has the form

$$W = C_1 (I_1 - 3) + C_2 (I_2 - 3)$$

where C_1 is a constant and the ratio C_2/C_1 decreases, in general, as the deformation increases from about 1/4 at small deformations.

In order to see how these results may be applied to the interpretation of a rather more complex type of deformation, the problem of the deformation of a thin plane circular diaphragm of rubber clamped at its circumference and subjected to a uniform air pressure on one of its major surfaces, was studied theoretically. This problem had already been studied experimentally by Treloar [*Trans. I. R. I.*, Vol. 19, p. 201 (1944)] who measured the distribution of the longitudinal and azimuthal extension ratios over the surface of the inflated diaphragm. Many of the features of Treloar's results can be explained directly from the theory without lengthy calculation if the stored-energy function W has the form given above.

10:35 A. M.—The Study of Bonded Units. *J. M. Buist and W. J. S. Naunton (Imperial Chemical Industries, Ltd., Blackley, Manchester, England).*

In a previous paper [*Trans. I. R. I.*, Vol. 25, p. 378 (1950)] we differentiated between methods of testing bonding agents and bonded units; the present paper is concerned with the testing of bonded units. Complete evaluation of the strength of a unit involves a study of the strength of the component parts: (a) the bond and (b) the rubber. Conventional methods of testing the bond (cf., A.S.T.M. D-429) have been shown to be inadequate and a falling weight impact test has been developed. This test is convenient for testing the strength of the bonding agent and in order to insure that the maximum stress is imposed on the bond the thickness of rubber should be kept to a minimum (we recommend a maximum thickness of 1/16th inch). Information of direct interest to engineers such as the maximum blow which the bond can withstand without rupture along with the effect of repeated blows on the strength of the bond has been obtained. Throughout the work the stresses imposed on the bond have been measured.

The unit will be protected by using as soft and as thick a rubber as the limits of strength, stability, and space permit. The effect of fatigue on the rubber and the bond is important and the stresses developed during repeated impact from various energy inputs with both gum and tread stocks have been measured. With the higher energy inputs the energy absorption of the "pad" has been shown to be larger in the first few blows due to the energy absorbed in the rearrangement of internal structure. Measurements of the maximum stresses developed with a 1/16th-inch thick layer of rubber and with the thickness of rubber to be used in service give an assessment of the efficiency of the design of the unit. For example, increasing the thickness of rubber from 1/16th to one inch can reduce the maximum stress imposed on the bond by as much as 70%. In the design of bonded units it is well known that "shape factor" is important and previous attempts to explain the phenomena of shape factor have not been entirely satisfactory. We have calculated that

$$I = \frac{S'A}{2E} \cdot 1$$

and the implications of this equation are that the only important factors governing either the energy of rupture (I) or the breaking stress (S) are the volume of the rubber test piece (A × 1) and the modulus of the rubber stock (E). This hypothesis has been examined by practical experiments with units having a constant volume of rubber with the following shapes: cylinder, hollow cylinder, square, and ellipse.

A bonded unit can fail in service due to failure in the rubber and this may be caused by tear propagation from small flaws, cuts, or abrasions under repeated stressing. A new method of studying the tearing of the rubber stock under impact has been developed and is discussed.

11:00 A. M.—Goodyear Lecture: Some Real Pioneers of the Rubber Industry. *C. C. Davis (Boston Woven Hose & Rubber Co., Cambridge, Mass.).*

No abstract available.

Thursday Afternoon—October 12

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

2:00 P. M.—Butadiene-Styrene Resinous Copolymers. *J. D. D'Ianni, L. D. Hess, and W. C. Mast (Goodyear Tire & Rubber Co., Akron, Ohio).*

In the past five years resinous copolymers of butadiene and styrene have become of great commercial importance. This development has been spurred by the availability of these monomers in large quantities and at low prices as a result of the synthetic rubber program sponsored by the Government in cooperation with the rubber and chemical industries.

It was therefore considered of interest to prepare under carefully controlled laboratory conditions polystyrene and a series of five butadiene-styrene copolymers containing from 10 to 50% butadiene for a study of latex and solid polymer properties as a function of polymer composition. The polymers were prepared at 50° C. in a GR-S type polymerization reaction carried to substantial completion. With increase in butadiene content, the amount of modifier was increased, the reaction time increased, and the pH of the latex from the reactor decreased slightly.

Latex properties examined included viscosity, pH, surface tension, soap requirement, turbidity, mechanical stability, chemical stability, and properties of latex cast films. The average latex particle size, as estimated from turbidity values, decreased regularly with increasing butadiene content, but the variation was small and all values were in the range for Type II GR-S latex. The outstanding fact noted was that as the butadiene content increased, the mechanical stability deteriorated greatly but the chemical stability (resistance to coagulation with salt) markedly improved.

A wide variety of physical properties of the solid polymers in the uncured state was determined by standard procedures. With increasing butadiene content, the ultimate tensile strength, Shore hardness, Olsen stiffness, and heat distortion point values decreased, whereas the per cent elongation and rate of extrusion markedly increased. Water absorption values were unaffected by polymer composition. Refractive index and specific gravity values decreased, but not linearly, with increase in butadiene content. Electrical properties, as measured by power and loss factors, were adversely affected by increase in butadiene content. Oxygen absorption measurements at 150° C. showed an increase in rate of absorption with increase in butadiene content.

No compounding data are reported, but a brief summary of the literature on the use of high styrene resins in rubber compounding and in latex and solution applications is included.

2:30 P. M.—Plastics from Natural Rubber. *G. Salomon, G. J. van Amerongen, G. J. van Veersen, G. Schuur, and H. C. J. de Decker (Rubber Foundation, Delft, Holland).*

Since 1938 an extensive reesarch program has been carried out by the Rubber Foundation on the correlation of chemical structure and mechanical properties of macromolecules. In the course of this research, methods for the preparation of rubber derivatives from acid-stabilized natural latex were discovered. The properties of these products have been studied and can be interpreted in a general way from their molecular structure.

The primary reaction products consist of particles corresponding in size with the original, slightly crosslinked macromolecules in the latex globules and are therefore insoluble. As a consequence, the technology of latex derivatives differs considerably from that of the same or a similar derivative prepared in solution. Several applications have reached the technical stage.

Latex chlorinated rubber has a lower chlorine content and a slightly lower stability compared with the classic product prepared in solution. Besides that, it is often virtually insoluble in the conventional paint vehicles because of a slight amount of crosslinking. On the other hand, from the product a stable latex can be obtained, which makes new applications possible. After adding a suitable amount of plasticizer and stabilizer, coherent films of satisfactory properties can be produced from this latex. Recently, a properly soluble chlorinated rubber of high chlorine content (up to 70%) has been obtained by means of an after-treatment of the latex chlorinated rubber.

Cyclized rubber from latex, an insoluble, thermoplastic, finely divided powder, can be processed with softeners of the paraffinic oil type and with cheap fillers. It differs from the known derivative by the remarkable reinforcing effect it has on rubber, when mixed in the form of a latex with rubber latex. This intimate mechanical mixture of latices can be processed and vulcanized as an ordinary rubber latex or it can be dried and then treated according to normal solid rubber technology.

Rubber hydrochloride from latex is also obtained as an insoluble, finely divided powder, but it differs from the foregoing products by its high degree of crystallinity. Part of this crystallinity pertains even near the decomposition temperature of 130° C. Processing methods have therefore to be adapted to these general properties, which resemble those of "Saran." The following three different possibilities of application have been developed:

1. High temperature processing can be facilitated by a partial breakdown on the mill of the carefully dried powder. The compounding temperature may thus be reduced to approximately 100° C. Small quantities of plasticizers are taken up readily. Larger quantities of even up to 60% are only retained by the polymer in the case of special types of plasticizers. Fillers are also taken up readily by the broken-down material. Products can be manufactured by calendering, molding or extruding. They possess outstanding chemical resistance in the dark. Light-aging is improved by the addition of pigments. Hardening, caused by after-crystallization, can be controlled by suitable compounding.

2. Films from the water-dispersed rubber hydrochloride can be prepared by adding a plasticizer emulsion and spreading on a metal belt, drying, and heating until gelation takes place above 100° C. Breakdown of the polymer on the mill is thus avoided and full advantage is taken of the original high molecular weight and stability. Water impermeability and mechanical properties of such films are comparable with those of Pliofilm.

3. Low temperature processing has been worked out lately. In contrast to the previous method the dry hydrochloride powder is combined with suitable softeners under conditions which make the breakdown of the large molecules unnecessary. Full advantage can be taken of the possibility to produce highly orientated products from the crystalline polymer.

3:00 P. M.—Reinforcement of Rubber. *R. Houwink (Rubber-Stichting, Delft, Holland).*

It appears impossible to define the reinforcing of polymers in respect to their mechanical behavior in general but only in respect to a particular mechanical property. Examples are given that reinforcement in a certain direction may even involve weakening in other respects. A thermodynamic approach to the background of reinforcement along similar lines as has been made to the principles underlying the phenomenon of plasticizing, does not lead to a satisfactory result. There is evidence that instead of applying thermodynamic laws of an integral character it is more justified to apply a type of spot thermodynamics emerging from step by step heat of adsorption measurements. Along this line it appears that the topographical conditions on the surface of filler particles play a prominent part in reinforcement. The Mullins' effect can be related to the presence of sites of different adsorption energy.

A comparison is made between the classical reinforcement by discrete particles and the structural reinforcement by resins. Considering the problem of reinforcing rigid polymers, the conditions appear to be just opposite to those for soft polymers. The fact that for the rigid ones coarse fillers are to be preferred is explained with the aid of an improved distribution of stresses. The applicability of stress-strain curves for studying reinforcing effects is disputable.

3:35 P. M.—A Dynamic Study of Reinforcement. *J. R. S. Waring (Imperial Chemical Industries, Ltd., Blackley, Manchester, England). (Note: J. M. Buist will present this paper).*

Reproducible results on the dynamic modulus of tread stocks of natural rubber, Neoprene GN, GR-S and Perbunan can be obtained if sufficient attention is paid to the control of such factors as static load, bonding of the test sample, temperature and temperature history, amplitude of vibration, and vibration history. Measurements in the range 100-300 cycles per second show that doubling the frequency of test has little effect, with the possible exception of Perbunan. Experimental values are given for the temperature and amplitude coefficients of dynamic modulus.

The importance of dynamic modulus, measured under controlled conditions, as an estimate of the general level of reinforcement is discussed. Two further quantitative measurements of this factor, in terms of the strength of the cohesive bonds, are proposed, the first being derived from the temperature variation and the second from the amplitude effect.

Measurements of the decrease of dynamic modulus and electrical conductivity on the same sample show that the rupture of more than one type of cohesive bond is involved in repeated cycles of vibration. The drop in conductivity observed in GR-S and natural rubber tread stocks must in part be attributed to "decatenation" of the carbon structure. A tentative system of analysis of types of cohesive bond is suggested.

The relative effects of applied vibration and increased temperature in causing changes in dynamic modulus are compared. Certain differences are apparent from the experimental data. On the one hand, a rise in temperature increases conductivity while it reduces modulus; on the other hand, vibration can reduce both modulus and conductivity. An explanation is put forward in terms of a "thixotropic" breakdown of a relatively "hard" static structure subjected to the directional effects of vibration. The differences observed in the case of increased temperature are attributed to its random (i.e., non-directional) character.

The variation in dynamic properties, when the parameters are changed, is attributed to changes in both carbon-rubber and carbon-carbon configurations. It is suggested that the presence of a structure "dynamically hard" at small amplitudes is responsible for outstanding resistance to abrasion. This structure though largely of a "fortuitous" nature and composed of weak cohesive bonds is readily reformed in the rest periods between the successive blows occurring in tire service. This "fortuitous" structure is therefore of technological importance.

4:05 P. M.—Improvements in Accuracy of Hardness Testing. *J. R. Scott (Research Association of British Rubber Manufacturers, Croydon, England).*

Most hardness tests for vulcanized rubber depend on measuring the depth of penetration by an indentor under load, the penetration being measured by the movement of the plunger carrying the indentor. This movement must be measured from a zero position, and the fixing of this position has been the cause of most of the difficulties in obtaining accurate hardness measurements. In most instruments one of the following devices has been adopted, either (1) Zero Load—a known load (small compared with the main indenting load) is applied to the indentor, and its position under this load is taken as the "zero"; or (2) Presser Foot—an annular foot, surrounding the indentor, rests on the rubber test piece, and the depth of indentation is measured relative to the plane of this foot, on the assumption that when the tip of the indentor is just touching the rubber it lies in this plane.

Rubber test pieces generally are not perfectly flat and parallel-sided, even though they may be nominally so. It is shown that this fact leads to errors (which may be serious) in hardness measurements by instruments using either of the devices (1) or (2) mentioned above. Moreover, if plied-up test pieces are used to obtain the required thickness, or in testing articles that are very thick compared with their lateral dimensions, large errors can arise if no foot is used. It is therefore concluded that the best general procedure is to use both a zero load and a presser foot. Experimental data support this conclusion, which has been embodied in the revised British Standard method (B. S. 903) and in the recommendations of Committee ISO/TC/45-Rubber.

Most published standards for hardness testing make no provision for avoiding errors due to friction in the measuring device (usually a dial micrometer gauge). Results are given of a co-operative program of tests which show that by applying gentle vibration (e.g., by an electrically-operated buzzer) during the test, much more consistent readings are obtained and it is possible to get better agreement between different laboratories and instruments.

Lubrication of the surface of the test piece with talc produces a definite though small further improvement in uniformity of results. It is not, however, adequate without vibration and should therefore be regarded as an additional precaution.

4:25 P. M.—Hysteresis of Vulcanized Rubber for Small Elongations. *P. Thirion and J. Martin (Institut Francais du Caoutchouc, Paris, France).*

The hysteresis of rubber has been studied mostly in the case of large elongations, while for small elongations (of the order of 0 to 100%) and for low speeds it has not been investigated very systematically. Since many applications of rubber are at low elongations, the value of the study of hysteresis under such conditions is obvious. This investigation is concerned with whether small deformations may cause hysteresis and if the phenomenon is similar for small elongations to that obtained for medium and large deformations.

For small elongations, the lever dynamometers usually employed in the rubber industry are not convenient because of their inertia and low degree of accuracy. We have therefore designed a piezoelectric quartz dynamometer free of these drawbacks. It is possible with this apparatus to take photographs on the screen of a cathode ray oscilloscope of the extension and retraction curves (load as a function of elongation) of rubber rings or dumbbells kept at a given temperature (—30 to +70° C.) by a thermostatic bath.

The apparatus works automatically and can perform, with a minimum of lost time when the reversal of motion takes place, any number of cycles between two given elongations (0 and 100%). The greatest speed of extension and retraction is 48 cms./min.; the lowest speed 8 cms./min.

The use of quartz for the measurement of the forces involved has the advantage of giving without any delay the simultaneous values of the loads and of the deformations. Important differences in the results obtained may then appear when they are compared with those obtained by former methods which neglected the immediate effects of "heredity" on the high elasticity.

The new apparatus has been employed in order to find a mode of fixation of the samples giving really significant tensile curves. It has been found that dumbbell test pieces are preferable to rings, since friction against the pulleys with the latter is an important cause of error even when the surfaces in contact are lubricated.

Further work with this new apparatus is to include a study of the shape of tensile curves for small elongations for a large number of compounds and also, more particularly, a study of the hysteresis of compounds containing fillers.

Thursday Afternoon—October 12

Red Room, Hotel Cleveland
J. H. Fielding, Presiding

2:00 P. M.—A Retraction Test for Serviceability of Elastomers at Low Temperatures. *O. H. Smith, W. A. Hermonat, H. E. Haxo, and A. W. Meyer (General Laboratories, U. S. Rubber Co., Passaic, N. J.).*

A retraction test employing large deformations is described which rapidly gives a temperature index correlating with ultimate stiffness of elastomer vulcanizates at low temperatures. This test, based on the T-50 test, can be used to measure the merit for low temperature applications of both crystallizable and non-crystallizable elastomers.

Various methods such as torsion modulus tests have been used

for the determination of the stiffening of elastomer vulcanizates at low temperatures. Progressive stiffening caused by crystallization of elastomers of regular structure normally occurs over a long period of time. Therefore, tests of this type which employ small deformations are not suitable for measuring ultimate stiffness unless long periods of storage at low temperatures are used. Crystallization and the consequent stiffening are markedly accelerated by extensive deformation of the sample prior to cooling.

In the retraction test the sample is stretched 250% and chilled to —70° C. for 10 minutes. The stress is released and the temperature is raised 1° C. per minute. Temperatures are recorded at which there is 10%, 30%, 50%, and 70% retraction of the original elongation. The temperature at which 70% retraction (TR70) occurs is the preferred index of the relative merit of vulcanizates for low temperature service.

This retraction test has been used for the study of the low temperature performance of vulcanizates of GR-S, Hevea and Paracril elastomers. The order of merit is GR-S, Paracril 26NS90, Hevea, whereas torsion modulus tests with no storage period rate Hevea as the best. It is well known that crystallization of Hevea causes progressive stiffening on storage at low temperatures which proceeds slowly under the small deformation of the torsion modulus test. GR-S and Paracril do not crystallize.

A detailed study was made of the behavior of polybutadiene and butadiene-styrene copolymers prepared at various temperatures. It was shown by X-ray and dilatometer measurements that the amount and rate of crystallization of these polymers increased with (1) decreasing temperature of polymerization, (2) decreasing styrene content and (3) decreasing combined sulfur in the vulcanizate. The effects of these variables on TR70 are presented. Data are given also showing the correlation of TR70 for these vulcanizates with cold compression set and hardness after low temperature storage.

2:30 P. M.—Evaluation of Diene Type Elastomers for Oil and Solvent Resistance and Low Temperature Flexibility. *R. W. Laundrie and M. Feldon (Government Laboratories, University of Akron, Akron, Ohio) and A. L. Rodde (Office of Rubber Reserve, Washington, D. C.).*

Copolymers of butadiene with styrene, acrylonitrile, methacrylonitrile, alkyl acrylates, vinylidene chloride, diethyl fumarate, diethyl chloromaleate, methyl isopropenyl ketone, dimethyl vinyl ethynyl carbinol and methyl vinyl ketone, and tripolymers of butadiene and acrylonitrile with butyl, 2-ethyl hexyl and octyl acrylates were prepared at 14° to 122° F. on a pilot plant scale. The resultant polymers were examined in recipes with high carbon black loadings (40 to 50 parts per 100 parts of polymer) for stress-strain properties, resistance to oils and solvents, and low temperature flexibility.

The stress-strain properties of the polymers with about 70 parts of butadiene were satisfactory and tensile strength values for stocks cured for 60 minutes at 292° F. decreased in the order of the following comonomers: styrene (polymerized at 41° F.); methyl isopropenyl ketone, dimethyl vinyl ethynyl carbinol, styrene (all polymerized at 122° F.); acrylonitrile, methyl acrylate, ethyl acrylate, octyl acrylate, butyl acrylate (all polymerized at 41° F.); diethyl fumarate (polymerized at 104° F.); diethyl chloromaleate (polymerized at 100° F.); 2-ethyl hexyl acrylate (polymerized at 41° F.); methyl vinyl ketone (polymerized at 104° F.); vinylidene chloride (polymerized at 122° F.), and methacrylonitrile (polymerized at 104° F.).

The low temperature flexibility, as determined by the Gehman method, of copolymers with about 70 parts of butadiene deteriorated in the order of the following comonomers: octyl acrylate, 2-ethyl hexyl acrylate, butyl acrylate, vinylidene chloride, ethyl acrylate, methyl acrylate, styrene, diethyl chloromaleate, methyl vinyl ketone, diethyl fumarate, methyl isopropenyl ketone, dimethyl vinyl ethynyl carbinol, acrylonitrile and methacrylonitrile. The freeze resistance of the acrylates deteriorated with decreasing molecular weight; the 70/30 butadiene/butyl, 2-ethyl hexyl or octyl acrylates copolymers had better low temperature flexibility than did natural rubber. The methyl acrylate copolymer was about equivalent to that of GR-S and poorer than that of natural rubber. Only polybutadiene and high ratios of butadiene in certain of the copolymers had low temperature flexibilities better than those of the three acrylates of higher molecular weight that were tested.

The effect of the various comonomers in the polymers on the resistance to aromatic and aliphatic types of solvents is shown. Of the acrylates, oil resistance in both aromatic and aliphatic hydrocarbons became worse as the molecular weight increased.

The over-all resistance to aromatic and aliphatic solvents of polymers with about 70 parts of butadiene and about 30 parts of the following comonomers decreased in the approximate order: acrylonitrile, methacrylonitrile, methyl isopropenyl ketone, dimethyl vinyl ethynyl carbinol, diethyl chloromaleate, diethyl fumarate, methyl acrylate, methyl vinyl ketone, ethyl acrylate, styrene, vinylidene chloride, butyl acrylate, 2-ethyl hexyl acrylate and octyl acrylate.

It is evident from this work that no copolymers made from the foregoing comonomers and butadiene by emulsion polymerization have both satisfactory low temperature properties combined with oil and solvent resistance, compared to those of a butadiene/acrylonitrile copolymer containing about 20% of this monomer as the objective in oil resistance. The possibilities of using two of these types of comonomers with butadiene to obtain the desired properties are under investigation.

Data are presented that may offer leads to utilization of some of these types of polymers for specific purposes.

(Note: The work reported herein was carried out under the sponsorship of the Office of Rubber Reserve, Reconstruction Finance Corporation, in connection with the Government synthetic rubber program.)

2:55 P. M.—Use of Inclined Plane Tester to Determine Intrinsic Low Stress Properties of Rubber Compounds. *W. B. Dunlap, Jr., C. J. Glaser, Jr., and A. H. Nellen (Lee Rubber & Tire Corp., Conshohocken, Penna.).*

A hysteresis loop test made at low stress over a series of cures provides an extremely accurate measure of rate and/or state of cure. The test is performed on an IP-4 Serigraph inclined plane test machine using a molded two inch T-50 type specimen with a cross-section area of 0.01 sq. inch. The test pieces are conditioned and tested under controlled conditions of 75° F. and 57% R.H. Data is autographically recorded.

The test is extremely accurate and reproducible and practically eliminates the human element in stress-strain testing. The load data at 50%, 100% and 150% elongation on the shortest cure of the series provides a scorch test which is accurate enough for practical factory control. The ratio of modulus on initial load at 50% elongation to modulus on recovery at 50% elongation provides a measure of hysteresis loss which is at least as accurate and possibly more accurate than one of the standard hysteresis tests commonly used. It is further believed that measurements made in the range of 50% elongation are a more accurate measure of the properties of tire compounds since this range more closely approximates the conditions under which tire stocks operate in service.

This test also provides a considerable saving in testing time so badly needed in most laboratories today.

3:20 P. M.—Ultraviolet Spectrophotometric Analysis of Organic Rubber Accelerator Masterbatch Stocks. *Kenneth E. Kress (Firestone Tire and Rubber Co., Akron, Ohio).*

Recent trends in chemical analysis have emphasized use of physical or instrumental methods as auxiliary or alternate methods for established chemical procedures. The ultraviolet spectrophotometer offers a sensitive, accurate and particularly rapid method of analysis well adapted to control of many organic rubber compounding ingredients, especially where chemical methods may be inadequate or tediously complex and time-consuming.

When a solution of certain unsaturated organic compounds is exposed to ultraviolet radiation, the solution will absorb radiation of a frequency related characteristically to the molecular structure of the compound. This absorption of ultraviolet radiation is selective in nature and relatively strong at only a limited range of frequencies or wavelengths. By exposing a solution of certain accelerators to near ultraviolet radiation (220 mu to 400 mu), as isolated by the quartz prism of a Beckman Model DU ultraviolet spectrophotometer, and recording the amount of absorption, a characteristic spectral curve of rising and falling ultraviolet absorption is obtained.

Since the intensity, as well as frequency, of vibration is essentially constant for the molecule in a given solution, the intensity

of absorption is proportional (within limits of Beer's Law) to the accelerator concentration.

The ultraviolet absorption of solutions of seven commercial accelerators investigated in the thiazole, guanidine, and thiuram sulfide classes were found to exhibit strong and characteristic selective ultraviolet absorption. Prepared mixtures of natural rubber and GR-S polymer with 10% and 25% of a single or a two component mixture of these commercial organic accelerators were dissolved in CP chloroform and analyzed spectrophotometrically.

In practice, the technique is simple and rapid. A typical analysis procedure involved dissolving a 4 to 8 mg. sample of the masterbatch stock in 50 ml. of chloroform by standing at room temperature for 30 minutes in the dark. This solution is transferred to the 1 cm. quartz spectrophotometric cells without dilution and the optical densities recorded at one to three selected wavelengths, depending on type accelerators present. The concentrations are then calculated according to established equations.

The mathematical aspects of spectrophotometric quantitative analysis were investigated with the object of simplifying and speeding calculations without an appreciable reduction in accuracy. Methods of establishing equations for absolute and relative per cent composition of single and two component accelerator masterbatches are described in detail.

Absolute accuracy and precision for a 20% masterbatch were both well within ±1%. This amounted to a relative accuracy of ±5%, and generally compared to limits of the relative accuracy of analysis of two component accelerator pigment mixtures by spectral methods.

3:40 P. M.—Polysulfide Liquid Polymers: A New Type of Vulcanizable Liquid Rubbers. *J. S. Jorczak and E. M. Fettes (Thiokol Corp., Trenton, N. J.).*

Thiokol LP-2, LP-3 and LP-8 are polysulfide polymers supplied in a low molecular weight liquid state. The polymers are prepared with reactive thiol terminals so they can be readily converted to a high molecular weight rubber over a wide range of curing temperatures. The cured rubbers have the physical properties characteristic of the polysulfide polymers, but are useful in a wide variety of applications due to the ease of handling a liquid material.

The polymers are prepared by the reaction of sodium polysulfide with dichloroethyl formal. A small amount of a trifunctional halide is used also to produce a lightly crosslinked rubber. The high molecular weight rubber produced from this reaction is treated with reducing agents to effect a controlled splitting of some of the disulfide groups in the chain. The number of disulfide groups split to yield two thiol groups determines the molecular weight and viscosity of the liquid product. The viscosity can be varied widely to meet needs of specific applications.

The liquid polymers as prepared are in a high state of purity and are stable over a period of years. They are readily vulcanized by oxidizing agents which are capable of reconverting the thiol groups to disulfide. The vulcanization can be controlled so that conversion to the high polymer takes place at any temperature in the range of 0-180° F. with negligible shrinkage. The curing agents which can be used practically include metallic oxides such as lead and zinc peroxide, organic peroxides such as cumene, t-butyl hydroperoxide diisocyanates such as toluylene diisocyanate, and quinone derivatives such as p-quinone dioxime. In conjunction with metallic catalysts such as cobalt, iron and manganese, the oxygen in the air can be used to convert thin films.

The liquid polymers can be used with soluble curing agents for the impregnation of leather, fabrics and wood. Penetration is easily accomplished and the polymer is then converted to a non-extractible rubber in place. The polymers can be compounded on a paint mill, in a ball mill, or in an internal mixer with fillers and reinforcing pigments. Carbon black, zinc sulfide, titanium oxide and aluminum oxide are among the best materials for practical uses. In the compounded form, they can be used as adhesives, casting compounds, coatings and sealers.

The cured liquid polymer closely resembles Thiokol Type ST in physical properties. They are substantially odorless and have a service temperature from —70 to 300° F. The polymers are resistant to oils, aliphatic and aromatic fuels and most solvents. They have good electrical properties and excellent ozone and oxidation resistance.

4:05 P. M.—Adhesion of Rubber and Textiles. V. Effect on Adhesion of the Amount of Spun Staple Yarn in the Fabric. *Eileen M. Borroff and William C. Wake (Research Association of British Rubber Manufacturers, Croydon, England). (Note: R. C. W. Moakes will present this paper).*

Parts I to IV of this series have been published [*Trans. I. R. I.*, Vol. 25, pp. 172-221 (1949)] and the present paper continues the series by reporting an investigation of the adhesion of a number of fabrics of different weave incorporating differing amounts of spun staple nylon yarn, the rest being continuous filament yarn. Before giving the results from these fabrics, critical attention is paid to the method of test and the conclusions of Part III are confirmed by trials of the direct tension test technique there proposed at varying rates of loading. The effect of the thickness of the rubber layer in the test piece is also investigated.

Using the direct tension test, it is shown that the logarithm of the load required to break the bond between rubber and the textile surface is linearly related to the number of fiber ends which are fractured when the bond is broken. This simple relationship is not greatly affected by the weave (the same spun yarn being used throughout the series of experiments), and it is shown that fiber fragments are also recovered after the adhesion of continuous filament material to rubber, the number of fragments recovered and the breaking load observed lying on the same curve as given by the series of spun yarn fabrics. These results, together with experiments on fabrics having loose fiber ends produced by brushing, confirm the hypothesis that the strength of a rubber-to-fabric bond is a simple function of the number of fibers ruptured in breaking the adhesive bond and of the strength of the individual fibers.

Friday Morning—October 13

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

9:00 A. M.—Some Problems Involved in the Grading and Testing of Natural Rubber. III. The Relation Between Compound Viscosity and Vulcanizate Stiffness. *R. F. Blackwell, C. M. Blow, and W. P. Fletcher (British Rubber Producer's Research Association, Herts, England).*

In Parts I and II of this series, references have been made to the relation between the viscosity, as determined by the Mooney shearing disc instrument, of the mixed compounded unvulcanized stock and the minimum strain of the vulcanizate therefrom, i.e., the elongation at a load of 5 kgs./cm.^{2} of the vulcanizate cured for the period needed to make this strain a minimum. These results were obtained on one batch of raw rubber using the A.C.S.-I formula and further work is now reported in which (a) a range of raw rubbers of different characteristics has been examined, (b) mixing formulae other than the A.C.S.-I have been used, and (c) mixing procedures have been varied.

Mixings with normal sulfur and low in accelerator content of the mercaptan type generally show sensitivity, i.e., the slope of the regression line of the minimum strain, S_m, on the viscosity of the compound, V_c, is of the order of —0.5 to —1.0. The addition of an amine type accelerator such as DPG. produces both a reduction in the slope of the regression line and a decrease in the strain at a constant V_c. In the same way the non-rubber constituents in the raw rubber affect both these properties. Different samples of rubber, varying in content of accelerating non-rubber substances, show strains and regression slopes which are related to one another. Results are presented and a formula is given from which the minimum strain at a fixed V_c (=40) can be calculated from S_m and V_c.

The Mooney viscosity may be regarded as a rough relative measure of an average molecular weight, but there is no reason to believe that this average molecular weight will completely determine the minimum strains of vulcanizates from a given rubber. It may well be that the distribution of the molecular weights about the mean will, at least, be a modifying factor. It is, therefore, of interest to compare the strain results obtained on a series of mixes prepared from the same ingredients but with varying procedures. V_c's of approximately 20, 30, 40, 50, 60, and 70 were obtained by three methods:

(a) Blends of the unmasticated rubber with varying propor-

tions of the same rubber broken down to a viscosity of 20 were mixed with vulcanizing ingredients in an atmosphere of nitrogen so that no further breakdown occurred.

(b) A batch of compound was mixed from unmasticated rubber and vulcanizing ingredients in nitrogen, and subsequently broken down on the mill to give a range of V_e's.

(c) Batches were mixed on an open mill under such conditions that V_e varied over the above limits.

While the differences between these three groups of rubbers were not large, they were significant. The practical and theoretical implications of the above observations are discussed.

9:25 A. M.—Some Problems Involved in the Grading and Testing of Natural Rubber. IV. The Definition and Measurement of "Rate of Cure". *Geoffrey Gee (British Rubber Producers' Research Association, Herts, England).*

There is wide recognition of the desirability of some measure of the rate of cure of a sample of natural rubber, but much difference of opinion as to the meaning of the term. For the purpose of this paper we assume it to have its obvious meaning as a rate constant defining the vulcanization process. It will then be for further discussion whether this is in fact a useful quantity to determine.

According to one school of thought, rate of cure is measured (inversely) by the time to reach optimum modulus in a given compound. It is, however, obvious (a) that this time is only finite when the vulcanization curve possesses a maximum, and (b) that there is no maximum unless the compound shows reversion. Although, therefore, time to optimum cure is technically of great importance, it cannot without further justification be taken as a measure of rate of cure.

A second school of thought relates rate of cure with scorching tendency. Although adequate data are lacking, it appears certain that scorch time must be highly dependent on the viscosity of the mixed compound. Moreover, if a delayed action accelerator is used, scorch time is in effect a measure of the delay period, which is not necessarily related to the subsequent rate of cure.

The U. S. National Bureau of Standards method of fitting the vulcanization curve to a hyperbola recognizes these difficulties and defines three parameters which may be taken to measure (1) the optimum modulus (minimum strain); (2) the rate of cure (rate of growth of modulus); (3) the time delay (if any) before the onset of appreciable vulcanization.

This third approach is considered the most satisfactory yet proposed, but still not ideal. Since it neglects reversion, it is not, as it stands, strictly applicable to most natural rubber mixes. A general criticism of this method is that it uses an empirical equation, and we have found it possible to replace this by one derived from kinetic arguments. Possibly even more serious in practice is the difficulty of fitting this or any other multiparameter equation to a few experimental points. Inevitable uncertainties in the data must be reflected in relatively large uncertainties in the derived constants.

A critical appraisal of these methods requires more experimental data, especially of the early stages of cure. This is now in hand, and a progress report will be presented at the Conference.

9:50 A. M.—The Tackiness of Masticated and Compounded Rubber Mixes. *A. Van Rossem and J. M. Vercruijsse (Rubber Research Institute T.N.O., Delft, Holland).*

In recent years methods have been published by various investigators to measure the tack of rubber mixes, for which purpose special apparatus have been developed. The present writers have modified a method which was applied in 1930 by de Visser for measuring the adhesion strength of rubber flooring with various cements, and allows for the application of an ordinary dynamometer. Two wooden test pieces are covered with the calendered rubber mix to be tested, stuck together under a certain weight and subsequently separated with a dynamometer, the force being measured.

Various factors which influence the result of this test have been studied experimentally, e.g., the influence of the weight applied, the time of sticking, the roughness of the test pieces, the speed of the dynamometer, and the influence of the temperature.

Subsequent experiments have been carried out with natural rubber mixes. The influence of the plasticity of masticated natural rubber was measured. Between a plasticity of 80-40 Hoekstra-units, the tack was about the same, but below that value tack could not be measured properly as the rubber was torn.

The influence of compounding ingredients such as whiting and carbon black even up to 40 vol. % was rather small, contrary to expectation. Softeners improved the tack of the natural rubber mix up to a certain percentage. Those compounding materials which have a tendency to bloom, such as stearic acid, show a considerable decrease in tack of the rubber mix as is known from practice.

Tack experiments have also been carried out with synthetic rubbers, such as GR-S and various neoprenes. With the GR-S mixings, special attention was paid to the increase of tack by various tackifiers, such as Koresin and other synthetic resins.

Consideration is given to the phenomenon of tack in general and the results obtained explained in the light of general theory.

10:25 A. M.—Cis- and Trans-Polyisoprenes from a Single Plant Species. *W. Schlesinger and H. M. Leeper (Research Laboratory, Wm. Wrigley Jr. Co., Chicago, Illinois).*

Previous published investigations have supported the contention that gutta (trans) and caoutchouc (cis) type polyisoprene hydrocarbon polymers do not occur simultaneously in a single plant. Our study reveals the existence of both gutta and caoutchouc in chicle. These two types have been found both in commercial chicle and in a sample of chicle especially obtained for this investigation from a single tree.

For isolation of the polymers, chicle, in the form of a whole dried latex, is dissolved in benzene and centrifuged to remove the insoluble portion. The benzene solution is treated with ethyl acetate to insolubilize the gutta and the filtrate from the removal of the gutta is treated with acetone to precipitate caoutchouc. An alternative method of isolation of the polymers involves acetone extraction of the whole chicle, followed by extraction of the acetone insolubles with cold petroleum ether. The caoutchouc is soluble in cold petroleum ether, while the gutta remains undissolved. The caoutchouc fraction is precipitated by treatment of the filtered petroleum-ether extract with excess acetone. The insoluble residue from the petroleum ether extraction is steeped in benzene and the resulting mixture is filtered. The gutta fraction is precipitated by addition of two volumes of ethyl acetate to this benzene filtrate.

Average analyses show the gutta to comprise about 14% and the caoutchouc 4% of chicle. Four samples of chicle, obtained from different geographical sources, yielded both polymer types in approximately the same percentages. The gutta, after purification, is a white granular material melting at 69-71° C., whose number average molecular weight is approximately 16,000. The caoutchouc, when pure, resembles a well-masticated sample of natural rubber pale crepe, and has a number average molecular weight of about 90,000.

Carbon-hydrogen analyses and infra-red absorption spectrum measurements confirm the identification of the polymers isolated from chicle, with the cis and trans forms of polyisoprene.

10:50 A. M.—Aspects of the Problem of Obtaining Uniform Malayan Rubber. *R. G. Newton (British Rubber Producers' Research Association, Herts, England). M. W. Philpott and H. Fairfield-Smith (Rubber Research Institute of Malaya, Kuala Lumpur, Malaya), and W. G. Wrenn (London Advisory Committee for Rubber Research, Ceylon and Malaya, London, England).*

The paper discusses the variability of Malayan rubber, with particular respect to Mooney viscosity and vulcanizing characteristics. The data were obtained from a sampling survey carried out preparatory to the introduction of a scheme for providing technically uniform Malayan rubber, based on the classification already in use in Indo-China.

All types of rubber examined showed considerable variability, but the several visual grades of smoked sheet (RSS 1, 2, 3 and 4) differed little in the properties examined. No technical justification was found for the down-grading of RSS on account of the presence of bubbles in the sheet, and it is suggested that one effect of this practice is to prevent fast-curing rubber from coming on the market. Marked differences in level of technological properties were observed for certain secondary or spe-

cial types, such as rubber made from centrifuge skim latex, undiluted latex, etc.

The survey of RSS was designed to permit the analysis of total variability into components. For estate-produced rubber the largest single component was found to be due to inter-estate differences. Thus, estates differed consistently from one another in the technological properties of their product, despite the fact that they all produced uniform rubber as judged by visual standards. Variation between sheets in a bale was found to be considerable, but this is of little consequence since the manufacturer is not concerned with the internal heterogeneity of a bale, but only with its average properties. Variation between bales produced on one day which, if large, would seriously add to the difficulties of providing uniform rubber was fortunately found to be small.

It follows that a day's output (lot) can be adequately classified by testing relatively few representative samples, and large uniform consignments of estate rubber can be built up by grouping lots bearing the same class-mark. The survey indicated that Malayan rubber marked in this manner would appear in the market mainly as "yellow" or "circle" rubber of the French Specification.

The grading of smallholders' rubber presents a rather different problem. The survey showed that the total variability of sheets from smallholdings is greater than that from estates, but that individual lots delivered by dealers to packing houses are relatively uniform within themselves. Uniform consignments of smallholders' rubber could, therefore, be obtained by packing the sheets systematically in such a manner that each lot is represented in each bale.

11:25 A. M.—Some Aspects of Peroxide Decomposition and Its Relation to Rubber Degradation. *C. E. Kendall (Dunlop Rubber Co., Ltd., London, England).*

The use of mercaptobenzimidazole (MBI) and related compounds as "deactivators" has been advocated recently, mainly by Le Bras and his co-workers, who state that although these compounds do not appreciably affect the rate of oxygen absorption, the amount of deterioration is much reduced. They considered that while the more usual antioxidants function by reducing the rate of peroxide formation, MBI acts by "deactivating" any peroxide formed. It was apparent that an investigation into the reactions of MBI and similar compounds would help to explain the action of these substances. During work on this subject, it has been found that under suitable conditions, a peroxide-MBI mixture is capable of causing active degradation of rubber.

MBI reacts with alkyl hydroperoxides or hydrogen peroxide to yield the disulfide or higher oxidation products; the reaction is rapid and exothermic. Oxygen is evolved if excess peroxide is present, when *tert.* butyl alcohol or benzene is used as solvent, but not in the presence of cyclohexene or of ethyl or isopropyl alcohol. Ethyl alcohol is oxidized to acetaldehyde. The suppression of oxygen formation with solvents which are readily attacked by hydroxyl radicals suggests a similarity with Fenton's reagent. Thiourea gives somewhat similar reactions, and a thiourea-hydrogen peroxide mixture shows the typical Fenton's reagent color reactions with aromatic amines. The evidence for OH radical formation indicates that a one-electron transfer to peroxide occurs, and it follows that radicals from MBI or thiourea must also be formed. During the peroxide oxidation of MBI to disulfide, an intense yellow color appears, apparently identical with that given reversibly on heating solutions of the disulfide.

These considerations lead to the conclusion that rubber itself would be attacked and degraded by MBI and peroxide. Addition of MBI with excess peroxide to a benzene solution of natural rubber leads to rapid reduction in viscosity, while neither MBI nor *tert.* butyl hydroperoxide alone has any appreciable effect. Among others, the following have been found to be effective in promoting degradation: MBI, thiourea, thioacetamide, thiouracil, diethyldithiocarbamate salts, MBT (less effective), thiophenol, and naphthyl mercaptan. Aliphatic mercaptans are ineffective. Degradation can also be effected in rubber on the mill, and the process is being applied to latex.

Apart from their use as plasticizing agents and for preparing depolymerized rubbers, the reagents considered may be of interest as alternatives to the previously recognized peroxide activators.

Friday Morning—October 13

Red Room, Hotel Cleveland
J. H. Fielding, Presiding

9:00 A. M.—Permanganate Oxidation of Polybutadiene Rubbers, *F. J. Naples and J. D. D'Ianni (Goodyear Tire and Rubber Co., Akron, Ohio).*

The oxidation of natural and synthetic rubbers has frequently been used as a tool for the elucidation of detailed molecular structure, since under ideal conditions the polymer should cleave at the double bonds to produce relatively simple polycarboxylic acids capable of identification.

For example, polybutadiene consisting entirely of 1,4-addition units should yield only succinic acid (omitting end-group effects) under ideal oxidation conditions. Polybutadiene containing 1,4-addition units and a 1,2-addition unit between two 1,4-units should yield a mixture of carbon dioxide, succinic acid, and beta-carboxyadipic acid. Polybutadiene containing a branched structure formed by the 1,4-addition of butadiene to an allylic free radical of two 1,4-addition units should yield tricarballylic acid.

Ozonolysis has been employed for many oxidation studies of unsaturated polymers, but ozone may attack the molecule at locations other than the double bond. This study was undertaken to evaluate acidified potassium permanganate as the oxidant for several butadiene polymers.

The polybutadienes analyzed were emulsion polymers prepared at 50° C. and —10° C., and others prepared with sodium and Alfin catalysts. The purified polymer was dissolved in carbon tetrachloride and oxidized at 30° C. with an acidified aqueous potassium permanganate solution. The reaction mixture was filtered to remove manganese dioxide hydrate, the solvent layer was separated, and the aqueous layer was evaporated to isolate the organic acids. The organic acids were separated by a partition chromatographic technique developed by Marvel and Rands.

In separate experiments the amount of carbon dioxide formed on oxidation was determined. The —10° emulsion polymer produced the least amount of carbon dioxide, and the 50° polymer, the Alfin polymer, and the sodium polymer increasing amounts in that order. These results correlated well with the external double bond content as measured by perbenzoic acid titration. Other experiments showed that volatile acids, such as formic and acetic, were not formed in appreciable amounts.

Analysis of the chromatograms revealed that the largest amount of succinic acid was obtained from the —10° C. polymer, and smaller amounts from the 50° polymer, the Alfin polymer, and the sodium polymer, thus indicating the —10° polymer to possess the most regular structure. The sodium polymer produced the largest amount of betacarboxyadipic and tricarballylic acids, whereas the other three polymers produced smaller and approximately equivalent amounts. Tricarballylic acid was definitely shown to be formed by a primary rather than a secondary oxidation process. The chromatograms of the two emulsion polymers and the Alfin polymer were quite similar, whereas the chromatogram of the sodium polymer was entirely different and contained a large number of unidentified peaks.

9:25 A. M.—A Contribution to the Study of Rubber Oxidation and Antioxidant Action. *S. Baxter, W. McG. Morgan, and D. S. P. Roebuck (Monsanto Chemicals, Ltd., London, England).*

Mechanism of auto oxidation systems with particular reference to the work of Farmer and Bolland is discussed, and consideration is given to the "interrelation of oxidation and vulcanization reactions"; the importance of chain transfer reactions is underlined. A new apparatus has been designed to investigate the problem of rubber oxidation in more detail than was previously possible. This apparatus, which is described, permits the simultaneous measurement of oxygen absorption, and deterioration of physical properties of a rubber sample, over a reasonably wide temperature range. Some preliminary results, indicating the effects of the variants, vulcanization and antioxidant, are given and discussed. The technological significance of this type of measurement is considered.

9:50 A. M.—Deterioration of Rubber under the Influence of Light and Dry and Moist Heat. *A. L. Soden and W. C. Wake (Research Association of British Rubber Manufacturers, Croydon, England). (Note: J. R. Scott will present this paper).*

Exposure of rubber articles and proofings to tropical atmospheric conditions results in a more rapid deterioration than is experienced in temperate climates. Moist heat aging tests have been proposed as accelerated exposure tests for the behavior of rubber, and a series of experiments is reported in which the effect of exposure to moist heat is compared with conventional dry heat aging in a Geer oven. In addition to this, samples were exposed in two tropical localities, one with a hot dry climate and the other with a hot wet climate. The samples were in free air but protected from direct sunlight.

It might be thought that the presence of moisture, if absorbed, would enhance chain scission. It is shown that moisture is absorbed in substantial quantities as the aging proceeds, even by compounds normally regarded as non-absorbent. With accelerated tests, the moist heat aging does have the effect of encouraging chain scission compared with compounds aged dry at the same temperature, but the vulcanizates aged naturally show an order the reverse of this. This might be due to a temperature differential, but is more likely to be due to the excessive surface deterioration of those exposed dry. This deterioration is the surface crazing caused by oxidation in the presence of strong light.

Rubber, swollen with inert materials to produce an absorption comparable to the water absorbed in the moist heat aging, does not, when aged dry at the elevated temperature, deteriorate in proportion to its swelling, nor is its deterioration comparable to that of the compounds aged in moist heat. The effect of moist heat is other than through the effect of the physical adsorption of water which it also causes.

The behavior of the tropically aged vulcanizates emphasized the importance of exposure to suitable light radiations as part of any accelerated "tropical" test. The infrared adsorption spectra of these rubbers show the profound changes which occur at the surface due to light catalyzed oxidation. The early stage of this light catalyzed oxidation manifests itself as a stiffening in very thin films of rubber. This stiffening is easily followed by simple modulus measurements and can be correlated with changes in the absorption spectra of the rubber. Tests of this type for detecting the tendencies towards light stiffening and surface crazing may thus be of greater importance for simulating tropical conditions than the tensile behavior after exposure to moist heat.

10:10 A. M.—Factors Influencing the Creep and Stiffness of Vulcanized Rubbers. *D. H. Cooper (Dunlop Rubber Co., Ltd., London, England).*

The work described in this paper is being carried out with a view to predicting more accurately than is at present possible the deflection of rubber springs. It is concerned with stiffness and with creep under a constant load. It shows the influence on these two properties of certain factors, which though essential to the design of commercial products, are usually omitted from fundamental studies and have never been brought together in one single group of experiments. The variables are now considered under four headings.

(A) In this work, three polymers have been selected to form four basic mixes, a dual accelerator natural rubber bonding mix, a single accelerator resilient natural rubber mix, a neoprene mix and a Hycar mix. Each basic mix has been compounded at four levels of black reinforcement ranging from a pure gum to a heavily loaded stock.

(B) The main experiment has been conducted on cylindrical specimens of diameter/height ratio = 1.6 and a subsidiary experiment used to investigate the shape-factor effect in which this ratio is varied from 0 to 20, the lower limit being obtained by the use of lubricated end specimens. The distinguishing feature of the main experiment lies in the fact that a large number of separate but similar specimens have been loaded to give two readings in compression, or two in tension, or three in shear, using stresses to 120 p.s.i. and strains to 100%.

(C) The load is in the form of a hanging weight, whose application requires the relatively short period of two seconds, but which can be maintained for any required length of time. Measurements of deflection are made in accordance with a time schedule of 0.3, 1, 3, 10, etc., minutes up to three weeks.

(D) Temperature was controlled at 70° F.

Creep curves of natural rubber are linear against log time over the working range and the creep rate can consequently be defined by a single parameter.

The shear creep-rate "a" is proportional to shear strain and the direct (i.e., tensile or compressive) creep rate is a simple function of direct strain whose gradient at the origin when plotted against strain equals the shear creep rate per unit shear strain, "b." The creep rate in compression is slightly less and in tension slightly more than that in shear and expressible in terms of the shear creep rate "b," and the prevailing stress and strain.

The influence of black reinforcement and state of cure on stiffness and on the above creep constants is shown graphically or by comparative sets of values. A set of figures for comparative dynamic stiffness in shear is also included.

In neoprene, a similar analysis has been carried out, but a power law replaces the above log law.

A discussion follows on the influence of the variable factors on the fundamental mechanism of creep.

From the practical point of view, this report also underlines the need for the strict control of time and other factors during stiffness measurements. An example shows how the deflection of a spring after 48 hours under load may be estimated from a process control test of one minute.

10:35 A. M.—Rheometric Tests and Extrusion. *Silvio Eccher (Pirelli Societa per Azioni, Milan, Italy).*

A cylindrical rheometer, Couette type, suited to the experimental determination of the relationship between D and τ (D = rate of shear sec^{-1}, τ = shear stress Kg./sq. cm.) of rubber and rubber compounds is described. A full-length report is given of the results obtained on 25 different materials, of natural and synthetic rubbers, and compounds of both, with fillers of various sorts. The measures fall within shear rate limits from 1 to 100 sec^{-1}.

In this interval the relationship between log D and log τ is fairly near a straight line. It may therefore be analytically interpreted by the exponential expression Ostwald-De Waele $D = \left(\frac{\tau}{c}\right)^n$. The materials are thus characterized in the same interval by the parameters n and c.

An examination is then made of the course of the rheometric curve beyond the shear rate interval specified above, bearing in mind the work which has been done by other experimenters.

Agreed that the expression Ostwald-De Waele is accepted as being of limited validity, attempts are being made to ascertain the limits of approximation of its integration in the case of rheometric flow through a cylindrical hole.

The results of measurements carried out on a 2-inch extruder employing the same materials as were tested by the rheometer are then set out in detail. These measurements refer to the pressure and flow with discharge holes of various diameters and with the screw operating at various speeds. The flows range from one c.c./minute to 250 c.c./minute and the pressures from 20 Kgs./sq. cm. to above 400 Kgs./sq. cm., these being associated not only with the speed of the screw and the diameter of the discharge hole, but also with the characteristics of the materials.

An endeavor is then made to link up the results of the extrusion tests with the rheometric measurements, obtaining thereby a satisfactory picture of the whole.

11:00 A. M.—Safe Limits of Sample Thickness for Rubber Oxidation and Aging Studies. *George W. Blum, J. Reid Shelton, and Hugh Winn (Case Institute of Technology, Cleveland, Ohio).*

The rate at which a rubber-like material absorbs oxygen at constant temperature and pressure is determined by the relative rate of the chemical reaction and the rate of diffusion or permeation of oxygen into the sample. At constant temperature and pressure, both will be a function of the concentration of the dissolved oxygen. When one wishes to study the effect of certain variables (molecular structure, vulcanizing agents, sulfur, antioxidants, etc.) upon the rate of reaction or oxidizability, it is essential to know that the conditions of the test are such that

the factor limiting the oxidation is the chemical reaction and not diffusion or permeation. It is the standard practice in studying the oxidation or aging of rubber to employ samples having a thickness of approximately 0.080-inch or 2 m.m., and to adjust the oxygen pressure and temperature so that the test may be completed in the desired short period of time. When it is sufficient to evaluate relative rates of deterioration of compounds under prescribed accelerated conditions of aging, this procedure causes no difficulty. When, however, one endeavors to draw pertinent conclusions regarding the oxidizability of the compounds from the results of such experiments, many confusing situations arise because the samples are often so thick that the limiting effect of diffusion is appreciable.

The purpose of this paper is to establish safe limits of sample thickness for gum and carbon black vulcanizates of natural rubber and three synthetic rubber types at various temperatures such that chemical reaction, and not diffusion, is the limiting factor. All experiments have been conducted in pure oxygen at 760 m.m. of pressure, using the volumetric oxygen-absorption method described in previous publications from this laboratory.

Oxygen-absorption data obtained with samples of different thicknesses are used to establish approximate safe limits of sample thickness for oxidation and aging studies. A method of calculating the probable limiting value of sample thickness above which the rate of oxidation in the autocatalytic stage is limited by diffusion has been developed in the case of GR-S and applied to Hevea, Butaprene NXM, and neoprene black and gum vulcanizates.

The conventional 0.075-inch to 0.080-inch thickness is frequently not satisfactory for accelerated aging and oxidation studies if it is desired to avoid limitation by diffusion. The problem is not so acute if the study is confined to the earlier stages of oxidation including the constant-rate stage of oxygen absorption, but not the autocatalytic stage.

Data are presented to aid subsequent workers in the selection of approximate safe limits of sample thickness for use in rubber aging and oxidation studies at various temperatures for both the constant-rate and autocatalytic stages of oxidation.

11:25 A. M.—Evaluation of a Volumetric Oxygen-Absorption Test for Rubber Aging. *J. Reid Shelton and William L. Cox (Case Institute of Technology, Cleveland, Ohio).*

A volumetric oxygen-absorption test for aging of rubber has been investigated from the point of view of the effect of cure, and the effect of mercaptobenzimidazole upon the aging behavior. The test has also been evaluated by comparison with conventional air-oven and oxygen-bomb tests, using four natural rubber stocks.

Time of cure has relatively little effect upon the rate of oxidation of either natural rubber or GR-S once a reasonable state of cure has been attained. The uncured compound is considerably more resistant to oxidation than the vulcanizate. Changes in physical properties corresponding to a given amount of oxygen absorbed vary somewhat with time of cure in the initial stages, but after the absorption of 4 or 5 ml. of oxygen per gram of rubber, neither time of cure nor the presence or absence of inhibitor has any significant effect upon the subsequent rate of change in tensile strength for a given amount of oxygen absorbed.

The reported superiority of a combination of mercaptobenzimidazole and a conventional antioxidant has been verified; however, the oxygen-absorption data indicate that the observed additional protection imparted by MBI results from a combination of two factors: (1) the normal antioxidant activity of MBI which reduces the amount of oxygen absorbed; and (2) an effect upon the nature of the cure attained when MBI is present such that the absorption of a given amount of oxygen in the early stages is not accompanied by as great a change in properties. After the early stages of oxidation are completed, the rate of change in tensile strength for a given amount of oxygen absorbed is the same with and without MBI. Thus it appears that the "deactivating effect" of MBI may be the result of the effect of this material upon the vulcanization process, rather than upon the oxidation process.

The three aging tests have been shown to rate four natural rubber compounds qualitatively in the same order. The effect upon physical properties is similar for the oxygen-absorption and air-oven methods (both at 100° C.) but the oxygen-bomb test (70° C. and 300 p.s.i.) apparently results in a higher proportion of chain-scission as compared to cross-linking, and it does not demonstrate as much of an effect due to MBI.

The effect of cure is very slight over the range studied in the case of the oxygen-absorption test; it is somewhat greater for the oxygen-bomb test, and it is very pronounced in the case of the air-oven method. This is one of the outstanding advantages of the oxygen-absorption method for aging studies since the effect of cure frequently obscures the effect of other factors under investigation when other aging methods are employed. The oxygen-absorption test thus appears to have a greater potential usefulness as a method for evaluating aging resistance of rubber stocks than the tests now commonly employed for this purpose.

Friday Afternoon—October 13

Ballroom, Hotel Cleveland
F. W. Stavely, Presiding

2:00 P. M.—Degree of Crystallization of Vulcanized Rubber as Calculated from the Temperature-Coefficient of the Elastic Tension. *B. B. S. T. Boonstra (Rubber-Stichting, Delft, Holland).*

Stress-temperature measurements were carried out with two well defined pure gum mixes in a temperature range of about +100° to —40° C. The vulcanizates were thoroughly relaxed at the highest temperature used in the experiment so that after cooling and reheating the stress attained practically its original value. Though no true equilibrium is reached under these conditions the changes of temperature were so slow (½ degree per minute) that the stresses measured were supposed not to differ appreciably from the equilibrium values. In cases where the tension after the cooling and heating cycle did not reach the original value, the measurements were discarded; in the regular cases the well known thermodynamical formula was applied. (E = energy, S = stress, L = length, T = temperature):

$$S = \frac{(dE)}{(dL)} + T\frac{(dS)}{(dT)}L$$

The plot of S vs. T consists for the major part of three straight lines—one for the higher temperature region where the rubber is completely amorphous, one for the lower temperature region when the rubber is partly crystallized, and one at the lowest temperatures where the rubber has reached its maximal crystallinity. These plots are determined at 200, 300, 400, and 500% elongation. In the region of the amorphous state the term $\frac{(dE)}{(dL)}$ is practically zero unless the rubber contains nuclei of crystallites that grow during cooling, as is sometimes the case at the highest elongation (500%). For the second region the value of the term $\frac{dE}{dL}$ is negative and more strongly so, the higher the elongation at which the measurement was carried out. This energy-term is plotted against elongation and the area under the curve is integrated; supposing potential energy effects to be negligible, this area represents the crystallization energy set free on elongation to the percentage considered here. Potential energy effects are small when not too high elongations are involved (max. 500%). By potential energy is meant here energy due to distortion of valence-angles or increase of interatomic distances other than as a result of crystallization.

The heat of crystallization on elongation calculated in this way is compared with the heat of crystallization of a piece of raw rubber of known crystallinity. As such, samples of raw rubber were used which had been stored for more than 35 years in the cellars of the Rubber Institute.

The degree of crystallinity was determined by X-ray analysis methods which have been described by Goppel and Arlman. The same sort of rubber was subsequently made molten by heating to about 70° C. and frozen artificially by cooling to about —20° C. and keeping at that temperature for some days. Again the degree of crystallinity was determined by X-ray analysis.

The heat of crystallization of these rubbers was determined directly by measuring the heat of swelling in toluene of the materials in frozen and in the molten condition; the difference yields the heat of crystallization.

When the heat of crystallization of the pure rubber crystallites is known, it is possible to calculate from the thermodynamic determination of the crystallization-energy of the stretched vulcanized rubber the degree of crystallinity at a definite elongation. The compounds measured were a sulfur vulcanized pure gum mix and one vulcanized with thiuram; the latter showed lower crystallization than the sulfur compound at corresponding elongations.

2:25 P. M.—Applications of Spectroscopy to Vulcanization Studies. *H. P. Koch (British Rubber Producers' Research Association, Herts, England).*

Attention is drawn to the use of ultraviolet and infrared spectroscopy in the identification and quantitative estimation of accelerators and their transformation products in rubber compounds. Such methods have recently been applied to the elucidation of the reaction between MBTS and simple olefines, and the results are discussed. The application of absorption spectroscopy to the identification of the sulfur linkages in cross-linked polymers is intrinsically much more difficult, but changes in the unsaturation pattern of natural rubber have been observed during vulcanization. These changes can now be correlated with recent advances in our understanding of olefin reactivity, and furnish virtually conclusive proof of the participation of free radical mechanisms in rubber vulcanization.

2:50 P. M.—Dynamic Properties of Raw and Vulcanized Polymers. *R. S. Enabnit and S. D. Gehman (Goodyear Tire & Rubber Co., Akron, Ohio).*

A technique is described for preparing samples of raw rubber and rubber-like polymers for dynamic measurements. The polymer is molded between two small concentric brass cylinders using a metal adhesive and a transfer type mold. The test piece is mounted in a Vibrotester and the inner brass shell oscillated longitudinally to produce a shear vibration in the polymer at about 60 c.p.s. Accuracy of measurement compares favorably to that usually obtained with vulcanized test pieces and in addition the method is applicable to vulcanizates as well as raw polymers.

The dynamic modulus and resilience of raw polymers were found to be substantially independent of frequency effects within the working range of the instrument. These properties were also found to be unaffected by changes in Mooney plasticity within the range of 35 to 70. Constant amplitude was used in all tests so that amplitude effects were eliminated from the comparisons.

Temperature dependence of the dynamic properties of a raw polymer is shown to deviate significantly from that of the gum stock vulcanizate. The resilience of the gum stock improves at higher temperatures and that of the raw polymer follows the opposite trend.

Data is given to show a definite correlation between the dynamic properties of a series of raw polymers and those of vulcanized gum and tread stocks prepared using them. This correlation is evident despite variations in the curing rate among the different polymers. Pigment loading is shown to affect similarly raw and vulcanized polymers.

The effect of cure on these properties is illustrated throughout a range from the raw state to overcure for Hevea, polybutadiene, and styrene copolymers. The resilience of Hevea is shown to rise rapidly with cure and decrease on overcure whereas for the diene polymers studied, resilience decreases initially followed by a continued rise. High styrene-butadiene copolymers exhibit a greater resilience in the raw state than polybutadiene but this relation is reversed as the cure progresses.

Curves showing the dynamic properties of raw butadiene-styrene copolymers vs. copolymer charging ratio indicate a superior resilience and lower internal friction for the high styrene materials. Similar plots for low temperature polymers show a pronounced superiority to the 122° F. polymers in all cases. A 41° F. polyisoprene polymer was found to have excellent dynamic properties comparable to those of sodium polybutadiene.

Comparisons were made of raw and cured butadiene-ethylacrylate and butadiene-methylmethacrylate copolymers over a large range of charging ratios. These show continued improvement of resilience with acrylate addition for the raw polymers but a maximum resilience at about 80-20 butadiene-ester ratio for the cured material.

The ease of measurement, small quantity of material required, and the nature of the correlations observed indicate the usefulness of dynamic evaluations for raw polymers. Furthermore, it appears possible with suitable background to anticipate fairly well from raw polymer measurements the dynamic properties which can be achieved in a vulcanized compound.

3:10 P. M.—Crystallinity of High Polymers. *H. N. Campbell and M. D. Allen (General Laboratories, United States Rubber Co., Passaic, N. J.).*

The crystallization of rubber, GR-S, polybutadiene, and polychloroprene has been studied by direct observation with the polarizing microscope. It is shown that such observations are more reliable in detecting crystallization than are X-ray diffraction methods. The microscopic results check reasonably well with dilatometer studies. It is deduced that considerable restriction is imposed on the possible motion of molecular segments so that theories of the origin and nature of retractive force in stretched elastomers may have to be modified.

Goodrich "Pallet Rollers" Used On Airplane Elevator Hoists

OFFICIALLY named a "pallet roller," new 6-inch "tires" manufactured by the B. F. Goodrich Co., Akron, Ohio, are used inside the new Douglas C-124 Globemaster II to serve as driving wheels for two electrically-operated elevator hoists. These "tires" never touch the ground yet must meet rigid traction specifications. The rubber compound has been formulated to withstand high and low temperatures ranging from —60° F. to 140° F. without shrinking from the traction surface. The roller also withstands high pre-loads without permanent set so that traction will be adequate while operating on inclines that may be as great as 6%. The electrically-operated elevator in each Douglas C-124 cargo plane uses four Goodrich pallet rollers. The elevator, located amidships, adds speed to cargo handling and, when used in conjunction with nose landing, permits loading and unloading at the same time.

Editorials. . .

Washington Scene

THE current Washington scene, as far as rubber is concerned, is strongly reminiscent of that which existed in the months following Pearl Harbor. Rubber men are in evidence in the halls of the Federal buildings, seeking greater supplies of rubber, natural and synthetic, to keep their mills and calenders operating, and offering suggestions to all and sundry on over-all programs to clarify the rubber picture. Even the charges and counter-charges, the accusations and denials, and the clamor for a centralized authority have a familiar ring.

The most serious charges were contained in the report issued by the Preparedness Subcommittee of the Senate Armed Services Committee, full details of which appear elsewhere in this issue. The subcommittee is headed by Lyndon B. Johnson (Dem., Texas), who personally has been highly critical of the government rubber program and who has been voluble in such criticism. The report, the first issued by the subcommittee since its organization in mid-July, touched on various aspects of the rubber program and was tartly critical of almost every phase.

Pointing out that where rubber is concerned there is no such thing as a surplus, the report charged that "until very recently this fact did not materially disturb complacency on the Potomac." It added that "we can no longer live under the illusion that 'business as usual' in rubber and an adequate defense of our national interests are both possible at the same time." It emphasized that "we must not have too little and be too late in our rubber program, particularly when we still have idle synthetic rubber capacity." It was particularly critical of the stockpiling program, stating that "it has been meagerly conceived and meagerly executed" and alleged that stockpiling authorities were virtually asleep at the switch since rubber acquisition plans "have been substantially revised downward during the last few weeks."

Basically, the Preparedness Subcommittee, according to the report, would like to see a six-step program instituted, along the following lines: (1) Immediate reactivation of all synthetic plants, with some thought given to the construction of additional plants; (2) A big step-up in natural rubber stockpiling; (3) Tighter government hold on natural rubber supplies through use of allocation, specification and inventory controls; (4) Unification of government rubber functions under a single agency; (5) An increased program of rubber research, including more progressive steps leading to production of natural rubber in the Western Hemisphere; (6) Cessation of attempted sales of government-owned synthetic rubber facilities, even though such facilities may have been declared surplus.

Actually, steps have been taken or are being prepared to meet most of the recommendations laid down by the committee, several of them having been in the works before the committee's report was issued. Current directives call for the reactivation of practically every synthetic rubber producing facility, copolymer and raw material, still owned by the government, and full production of most of these units will be achieved by the turn of the year. Once these plants are in full production, total output of all synthetics will approximate 840,000 long tons, which should prove sufficient even in a war-time economy. According to stockpiling authorities the Johnson Committee misinterpreted data supplied to it and that actually rubber acquisitions are on the increase. The additional rubber is expected to result from the consumption cut-back order which went into effect on September 1.

It has been no secret that for the past several weeks the Commerce Department has been preparing rubber controls covering allocation, specifications and inventory, and the industry is momentarily expecting the institution of such controls. In the light of recent publicity, and the directives calling for reactivation of synthetic units, it is extremely doubtful that any government-owned units will be declared or sold as surplus. The specific reference made in the committee's report, incidentally, was to the proposed sale of a 30,000-ton copolymer unit in Akron to General Tire, which has since been halted.

This leaves but two recommendations for discussion, namely, unification and rubber research. If another Bill Jeffers can be uncovered, then a revived Office of the Rubber Director could provide the answer. It takes a ruthless administrator, with nothing to fear, to cut across industrial and government lines, and there are few such executives available. As for increased rubber research, this should be instituted as quickly as possible, on the part of both government and industry, and if industry needs greater incentive it should be provided.

CURRENT NEWS OF THE MONTH

COMMERCE DEPARTMENT CURBS NEW RUBBER CONSUMPTION 13%

In a move intended as a mild, stop-gap measure to free natural rubber supplies for the strategic stockpile, the U. S. Department of Commerce, on September 1, ordered a 13% slash in civilian new rubber consumption. This action, accomplished in an amendment to Allocation Order R-1, includes natural and all synthetic rubbers, but excludes natural rubber latex.

Specifically, the Commerce Department told rubber manufacturers that during the last four months of 1950 they cannot use more than 4/12ths of their total new rubber consumption in the twelve months ended June 30, 1950. During the year ended June 30, 1950, 1,080,000 long tons of new rubber were consumed. The effect of the new order, therefore, will be to limit consumption of new rubber in the September-December, 1950, period to 360,000 tons.

Terms of New Directive

Under the terms of the new order it is also provided that if a manufacturer's August, 1950, total of new rubber consumption exceeded 120% of his average monthly total of the year ended June 30, 1950, that excess will be deducted from the total allowable new rubber consumption during the last four months of 1950. If the August, 1950, total of new rubber consumption is less than 120%, the total new rubber consumption allowable during the September-December, 1950, period will be increased by an equivalent amount.

It is stated, however, that in no one month of the September-December, 1950, period shall a manufacturer consume more than 28% of the total allowable new rubber consumption. The order further states that the maximum natural rubber consumption allowed for each manufacturer in the last four months of 1950 is computed by figuring the allowable new rubber consumption less his total synthetic rubber consumption.

The new limitations on the consumption of rubber do not apply to orders manufactured for the Department of Defense. Such orders are permitted in addition to previously determined totals. Appeals from provisions of the order may be obtained through the Rubber Division, Office of Industry and Commerce, Department of Commerce, Washington 25, D. C.

Further Orders Contemplated

Officials have stated that the interim order will be replaced by tighter specification controls specifically limiting the use of natural rubber in manufactured goods. This order may come within the next few months. Another order, expected next month, will probably require consumers of natural rubber to hold some of their stocks for government account.

During the latter part of 1950, each of the various branches of the rubber manufacturing industry will be called upon to recommend preference patterns, systematic step-by-step tightening of controls, for all-out mobilization. The tire and tube segment of the industry has already presented such a plan to the Commerce Department. Each of the industry branches will be asked how much natural rubber can be eliminated from various products without seriously impairing quality.

Comments by Industry

The Commerce Department's order trimming civilian rubber consumption by 13% should provide an incentive for the government to step up its synthetic rubber production program, said Harvey S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co., in commenting on the new order. He said the new order was important to our national defense, but, he said, we should increase synthetic rubber from existing plants as well as reactivating standby plants more quickly. "There is a growing demand for synthetic rubber throughout the world, which, if satisfied, will have the effect of reducing the world demand for natural rubber," Mr. Firestone said.

John L. Collyer, president of the B. F. Goodrich Co., said that the order was constructive and should make available rubber supplies adequate to provide for military and all essential civilian needs. Mr. Collyer also urged that the inactive plants constituting our "rubber insurance policy" be put into commission as rapidly as possible. Steps should also be taken to make certain that the U. S. receives a normal percentage of crude rubber from the Far East, he added.

Synthetic Safety Record

The U. S. Labor Department has reported that the synthetic rubber industry's employment-injury rate in the first quarter of 1950 was 2.4. The Department said that this figure was "outstandingly low" in comparison with figures established by other industries. Only one manufacturing industry fell below synthetic rubber during the quarter and that was the synthetic textile fiber field which had a score of 1.6. Statisticians in the Bureau of Labor Statistics figure the rates as the average number of disabling work injuries for every 1,000,000 hours worked.

ISO COMMITTEE ON RUBBER TO HOLD MEETING IN AKRON

Technical Committe 45 on Rubber of the International Organization of Standards (ISO) will meet at the Hotel Mayflower in Akron, Ohio., from Monday, October 16, through Friday, October 20. This will be the first meeting of the international committee in the United States, and is being held in this country at the invitation of the American Standards Association. The American Society for Testing Materials, as a member body of the American Standards Association, has designated Committee D-11 on Rubber to act as host at the meeting.

Copies of the tentative program for the meeting of Technical Committee 45 have been supplied to all subcommittee chairmen of Committee D-11 by Simon Collier with the request that they carefully review the program and attend the meeting prepared for specific discussion. L. V. Cooper (Firestone) is chairman of the local arrangements committee for the Akron meeting, and is prepared to answer any questions pertaining to it.

According to present plans, morning and afternoon sessions will be held on each day of the five-day meeting, and a dinner will probably be held some evening during the week. Discussions to be held, according to the tentative program, include the following:

Oct. 16 (Monday): Morning Session —Opening of meeting; Scope of Committee, Hardness testing. Afternoon Session—Tension stress-strain testing, Tear strength testing.

Oct. 17 (Tuesday): Morning Session —Ply adhesion testing; Aging. Afternoon—Abrasion testing.

Oct. 18 (Wednesday): Morning Session—Grading of raw rubber. Afternoon Session—Grading of raw rubber; Interlaboratory variations.

Oct. 19 (Thursday): Morning Session — Latex. Afternoon Session — Flex-cracking.

Oct. 20 (Friday): Morning Session — Rubber-to-metal bonding; Dynamic tests. Afternoon Session—Classification of vulcanized rubber by physical properties; Long term program; Confirmation of resolutions; Closing session.

Stauffer Research Laboratory

Stauffer Chemical Co., New York 17, N. Y., has announced that construction of a new research and development laboratory at Dobbs Ferry, N. Y., has begun. When completed, the building will house the research staff of the company's Eastern Division now scattered at several locations in and around New York City.

RFC RAISES ANNUAL OUTPUT OF SYNTHETIC RUBBER TO 755,000 TONS

The Government of the United States, on September 6, ordered the additional production of 80,000 tons of synthetic rubber, bringing the country's productive level to 755,000 tons annually. Harley Hise, chairman of the Reconstruction Finance Corp., said that the Government has made arrangements to reactivate one unit in each of the two Government-owned alcohol-butadiene plants located at Kobuta, Penna., and Louisville, Ky., with the necessary copolymer plant capacity for the annual production of 80,000 tons of synthetic.

Koppers Co., Inc., has received orders from the RFC to reactivate the butadiene unit at Kobuta, one of four it built and operated for the Government during World War II, and which it has maintained in standby status since that time. The operator for the Louisville alcohol-butadiene unit has not yet been announced.

Two prior directives, on July 7 and July 28, had ordered the additional production of 88,000 and 100,000 tons, respectively, of synthetic rubber. The latest order places the annual production of synthetic at 755,000 tons, of which 680,000 tons will be GR-S and 75,000 tons will be butyl. At this writing the Government has named operators for only those units reactivated in the first two directives on July 7 and 28.

On July 13, the RFC announced that the 75,000-ton GR-S plant at Port Neches, Tex., formerly operated by the B. F. Goodrich Co., will be operated by U. S. Rubber. The 45,000-ton unit at Borger, Tex., formerly operated by U. S. Rubber, is now to be operated by the Phillips Chemical Co. A 13,000-ton butyl unit at Baton Rouge, La., formerly operated by the Esso Standard Oil Co., will again be operated by Esso under the RFC order.

New Operators Named

Plants reactivated under the second directive included the GR-S plants at Torrance, Calif., and Louisville, Ky. The Torrance plant, formerly operated by the Goodyear Synthetic Corp., has been turned over to the Minnesota Mining & Manufacturing Co. and the Pacific Rubber Co. for joint operation. It has a rated capacity of 30,000 tons of GR-S a year. The Louisville unit, also of 30,000 ton capacity, was formerly operated by the National Synthetic Rubber Corp. Under the new order, the plant will be operated by the Kentucky Synthetic Rubber Corp., an amalgamation of 10 non-tire producing companies in the rubber industry. Details on Kentucky Synthetic appear elsewhere in this issue.

Butadiene producing facilities reactivated under the second directive include the 25,000-ton unit at Torrance, Calif., the 18,000-ton unit at El Segundo, Calif., and the 15,000-ton unit at Baton Rouge, La. The unit at Torrance will be operated by the Shell Chemical Corp., while the unit at El Segundo is to be operated by the Standard Oil Co. of California. The Louisville installation will be operated by the Copolymer Corp. This will mark the first time that a rubber producing agency has been named to operate a raw material-producing facility. The reverse recently held true when Phillips Chemical, a raw material-producer, was named to operate the GR-S unit at Borger, Tex.

The most recent directive, that of September 6, finds only two copolymer plants available for reactivation. One of these plants is located at Institute, W. Va., and has a rated annual capacity of 90,000 tons of GR-S. The other is located in Akron, Ohio, and has a rated capacity of 30,000 tons of GR-S. Sale of this Akron plant to the General Tire & Rubber Co. was recently halted by the Government.

The new high rate of production will not be reached until some time in 1951. Before the Korean war broke out, Government plants were operating at 360,000 tons a year. The two earlier directives pointed to an annual production of 675,000 tons of synthetic, until this latest order. Despite the prospect of a bigger supply next year, Administration officials have also decided on tighter restrictions on the use of rubber during the remainder of 1950.

The restrictions will take the form of more detailed allocations, limitations on inventories, and orders to manufacturers to follow certain specifications in the making of rubber products. Recently, the Commerce Department, which administers controls, ordered manufacturers not to use more new rubber, both natural and synthetic, in civilian products in the last four months of 1950, than they had used in an average four-month span in 1949.

Johnson Committee Statement

First word of the new directive on synthetic rubber was announced by the Senate War Investigating Committee, headed by Senator Lyndon Johnson (Dem., Tex.). This is an Armed Services Subcommittee which is fashioned after the so-called Truman Committee of World War II. The Johnson Committee said that it had prompted the latest boost in synthetic rubber production. It also said that, as a result of its protests, the Government had abandoned plans to sell the copolymer plant at Akron.

A report issued by the subcommittee stated that "it is important that steps be taken now to plan for and design new synthetic rubber facilities including those for component materials which would then be immediately constructed when necessary." The report added that Stuart Symington, chairman of the National Security Resources Board, has been asked to submit any plans the Government has for such an expansion program.

The report also stated that the Munitions Board recently "revised substantially downward" its goals for stockpiling natural rubber during the fiscal year which began July 1. Expressing "serious concern" over this decision, the members of the subcommittee said they "do not understand the basis" for such an order. They demanded that the step be reconsidered and urged that natural rubber be acquired for stockpiling "at the fastest possible rate."

In other highlights of the subcommittee report on rubber, the legislators urged stepped-up research and development by the Government and industry of new and improved types of synthetic rubber, and methods of processing it into such items as medium and heavy truck tires. "This country will not be secure as to rubber supply until synthetic rubber is a fully adequate substitute for all the important uses of natural rubber. We have continued and will continue to press the appropriate Government agencies to devote serious attention to these matters," the report stated.

The report also disclosed that the possibilities of growing natural rubber are being "explored" by the subcommittee. Inquiry has been made of the Munitions Board regarding its plans, if any, for the domestic production of natural rubber. The report also called for "incentive" production of natural rubber in the Western Hemisphere. This would mean U. S. subsidies for rubber production in South America.

New Round of Tire Price Rises

A third increase in the price of replacement tires since May of this year was made by most tire manufacturers in early August in an attempt to cope with the skyrocketing price of natural rubber. The move was initiated by the General Tire & Rubber Co., who, on August 2, raised the price of passenger car tires sold in the replacement market by 5%, and truck tires by 7½%. Tubes made of synthetic rubber did not change in price, but natural tubes were raised as much as 20%. Goodyear Tire & Rubber Co. raised the price of its natural tubes by 30%, while the B. F. Goodrich Co. raised the price of its truck tires from 7½ to 15%. Most other firms raised passenger car tire prices 5 to 10%, depending upon size. All companies attributed the rising prices to the unprecedented costs of natural rubber.

Brazil Plans Rayon Plant

A Brazilian firm, Companhia Nitro Quimica Brasileira, has entered into a contract with Oscar Kohorn & Co., Ltd., of New York, N. Y., for the construction of a plant to turn out 5,000,000 pounds annually of high tenacity rayon yarn for tires. The unit will be integrated with the large filament rayon and staple fiber plant now operated by the Brazilian concern. The contract, which runs to about $2,000,000, will increase the total investment in the plant to over $30,000,000. Brazil has been encouraging such a step for some time to protect supply sources for its tire industry. Both Goodyear and Firestone have Brazilian subsidiaries which have been importing rayon tire yarn.

Heads Government Patent Board

Dr. Archie M. Palmer of Tennessee has been appointed to serve as chairman of the Government Patents Board. This new, independent agency, established under Executive Order 10096, provides for a uniform patent policy for the government with respect to inventions by government employees. The board consists of the chairman and representatives of 10 government agencies.

UNITED STATES RUBBER EXPORTS SHOW 36.2% DROP IN FIRST HALF

United States exports of rubber, allied gums, and manufactures were valued at $42,195,536 in the first six months of 1950, a 36.2 per cent decline from the $66,108,567 worth exported in the period of 1949, the U. S. Department of Commerce recently reported. Exports in June this year were valued at $7,551,258, compared with $6,661,923 in May, and $10,102,419 in June, 1949. The June figure was the highest thus far this year, but lower than in any month of 1949 except November.

Review of Bureau of the Census statistics shows that among major categories of domestic exports, reclaimed rubber has joined synthetic rubber in exhibiting a gain over 1949 figures. Off-the-road casings and the "all other" category have also held up well, declining less than 5 per cent. Losses in other categories ranged from 9.9 per cent (rubber thread, cement, etc.) to 65.2 per cent for scrap rubber. Most of the decline in exports during the first half of 1950 can be traced to shipments of transportation goods (tires, tubes, camelback, and tire repair materials) which dropped 45.5 per cent—from $42,017,651 to $22,903,903. As a result, exports of transportation items represented only 54.3 per cent of total rubber group exports in January-June, 1950, compared with 63.6 per cent in January-June, 1949.

Rubber Imports Rise 16.8%

U. S. imports of rubber, allied gums, and manufactures were valued at $157,639,438 in the first six months of this year, up 16.8 per cent from the $135,000,248 reported in the like period of 1949. Categories other than natural rubber showed much larger percentage increases than natural rubber in the 1950 period, but natural rubber still accounted for 94.7 per cent of the total in the 1950 period, compared with 96.6 per cent in the 1949 period. The average declared value per pound of natural rubber imports was 17.1 cents in the 1950 period, as against 17.3 cents in the 1949 period, but this value has risen from 15.2 cents in January to 19.4 cents in June, and will rise further in coming months.

Consumption of Rubber in July

Rubber consumption dropped 6.75% during July to 103,524 long tons from the 111,012 long tons consumed in June, according to a recent report of the Rubber Manufacturers Association. Shutdowns in plants for vacations and maintenance work, although fewer in number than a year ago, accounted for a substantial portion of the decline.

Consumption of natural rubber during July amounted to 60,108 long tons, a reduction of 4.46% from the previous month when 62,914 long tons of natural rubber were consumed. Synthetic rubber consumption dropped to 43,416 long tons from 48,098 long tons in June, a reduction of 9.74%. Consumption of reclaimed rubber followed the same general trend as new rubber, and was estimated at 23,541 long tons, against the 25,244 long tons consumed in June, a drop of 6.75%.

Durex Phenolic Molding Compounds

Three new phenolic molding compounds have been placed on the market by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. The three, which are said to fall into the impact type classification and provide either properties or production performance heretofore unavailable, are Durez 13537 Natural and Durez 14482 Black, both high impact, fabric filled materials, and Durez 14658 Black, a nitrate rubber-bearing, wood flour-filled material. The two new fabric-filled materials utilize two-step resins, and therefore have greatly improved flow properties and finish and are less critical when electronically preheated.

Offers Ethylene Trithiocarbonate

The availability of ethylene trithiocarbonate, a bright yellow to brown crystalline solid containing over 70% sulfur, which may have value in the vulcanization of rubber, has been announced by the Stauffer Chemical Co., 420 Lexington Ave., New York 17, N. Y. Among other uses, it is suggested for use as an intermediate in the manufacture of organic chemicals, as a flotation agent, a sulfur solvent, and as an ingredient of extreme pressure lubricants.

Opens Export Consultant Office

B. S. Livingstone, president of the export firm of Livingstone & Southard, Inc., New York 4, N. Y., has opened an office as an export consultant offering service to American manufacturers and producers who desire to inaugurate or increase their export trade. Briefly, he will study their products, analyze foreign markets and make recommendations. The services of the export consultant in the export field will be somewhat similar to the consulting management engineer in the domestic field. Mr. Livingstone has spent more than 30 years in the export field and maintains offices at 50 Broadway, New York 4, N.Y.

Ferro Names Northwest Agents

Ferro Chemical Corp., Bedford, Ohio, has announced the appointment of Van Waters & Rogers, Inc., as sales agents for the Northwest territory, consisting of the states of Washington and Oregon, for their products of metallic soaps, stabilizers and driers for the rubber and other industries. Offices will be maintained at 4000 First Avenue South, Seattle 4, Wash., 3950 Northwest Yeon Avenue, Portland 10, Ore., and North 809 Washington Street, Spokane 11, Wash. Complete warehouse stocks will be carried in Seattle and Portland.

VIEW OF CABOT'S NEW STANLOW CARBON BLACK PLANT IN ENGLAND

An over-all view of the new Stanlow carbon black plant at Ellesmere Port, Cheshire, England, which was formally opened on July 28, as briefly reported last month, is reproduced above. The plant is being operated by Cabot Carbon Limited, wholly-owned British subsidiary of Godfrey L. Cabot, Inc., of Boston, Mass., and represents the first overseas venture by American private capital under an E.C.A. convertibility guarantee. It cost approximately £500,000 and was designed and erected by Cabot personnel together with a firm of British contractors. Louis W. Cabot, grandson of the founder of the company, has been in charge of the project since its inception. Sales are under the direction of Alfred Nash. When in full operation, the plant will produce approximately 20,000,000 pounds of high abrasion furnace black annually, company officials declared.

REPORT OF COMMITTEE D-11 ACTIVITIES AT ASTM ANNUAL MEETING

Committee D-11 on Rubber and Rubber-like Products held a total of some 20 meetings over a three-day period during the recent 53rd Annual Meeting of the American Society for Testing Materials, held in Atlantic City, N. J., during the week of June 26. Simon Collier (Johns-Manville) is chairman of Committee D-11, and presided at several sessions.

During the general meeting of the committee it was announced that the committee will act as host during the meeting of Technical Committee 45 on Rubber of the International Organization for Standardization (ISO), which will be held at the Hotel Mayflower in Akron, Ohio, the full week of October 16. Originally, this was to have been a two-day meeting in Cleveland preceding the International Meeting of the Rubber Division, A.C.S.

It was also reported that an organization meeting of the new Subcommittee on Crude Natural Rubber was held in Detroit on April 19 (a full report on which appears elsewhere in this issue) and that task groups have been appointed to develop methods for the quantitative determination of foreign material such as dirt, sand, bark, etc., in crude rubber. Another task group will give consideration to compounding formulas for natural rubber to determine the best recipe for evaluation. The subcommittee will hold a meeting in Akron at the time of the ISO session in October, since the work being undertaken by this subcommittee has considerable international interest.

Plans were made for the development of a series of statements covering the significance of the various tests applied to rubber and rubber products. The D-11 Advisory Committee will serve as a planning committee in initiating the preparation of this material which should be a very valuable publication when completed.

All of the recommendations on standards in the preprinted report were accepted and the committee announced that several recently completed methods and specifications as noted below would be presented to the Society through the Standards Committee subsequent to the Annual Meeting. One of the most important items included in the report was the extensively revised tentative methods of chemical analysis of rubber products. These revised methods are in general agreement with corresponding procedures of the Federal Specifications Board. They include the most up-to-date directions for the analysis of rubber products and should find wide acceptance in the industry.

A complete set of revised and up-to-date methods for the testing of flat rubber belt to replace the present Methods D 380 were accepted for committee letter ballot and submission as tentative to the Society.

The committee also received a new proposed tentative method of test for the accelerated ozone cracking of vulcanized rubber. This method is intended for use in estimating relative resistance of such materials to cracking when exposed, under tension, to air containing a definite low concentration of ozone. While the procedure is based largely on the work of Crabtree and Kemp as reported in *Industrial and Engineering Chemistry*, in December, 1946, it was completed after a series of round-robin tests to determine reproducibility and in particular the degree of uniformity obtained by individual laboratories in maintaining specified ozone concentration.

The S.A.E.-A.S.T.M. Technical Committee on Automotive Rubber submitted several recommendations for committee approval, including an extensive revision of the present tentative specifications for rubber and synthetic rubber compounds for automotive and aeronautical applications (D 735), also important changes in the tentative methods of test for contact and migration stain of vulcanized rubber in contact with organic finishes (D 925). The latter will include use of both the RS and S-1 Lamps. Work is being completed on a new method of test for heat and light discoloration of vulcanized rubber and organic finish coated compounds.

A number of new projects are under study in the technical committee including standards for evaluating color, color pattern, and color matching, abrasion testing, static exposure testing, low-temperature testing, and consideration of silicon rubbers. A revision of the present tentative specifications for natural rubber cups for use in hydraulic actuating cylinders (D 818) and new specifications for heavy-duty hydraulic brake cups are expected to be completed in the fall.

At the September meeting of the technical committee it is also expected that action will be taken on a comprehensive specification for gasket materials for general automotive and aeronautical purposes. These specifications will cover gaskets of the following types: rubber or synthetic rubber or compositions of both, cork compositions, paper and fiberboard, and asbestos fiber.

The Subcommittee on Rubber Thread reported that further round-robin tests are being made on specific gravity and on measurement of stress-strain properties under fixed load. The first set of methods for testing rubber thread are now published as information in the new edition of the special Compilation of A.S.T.M. Standards on Rubber Products, copies of which are now available.

The Subcommittee on Protective Equipment for Electrical Workers which also functions as A.S.A. Sectional Committee J6 announced that it had under study specifications for rubber gloves which will replace Standard D 120. Extensive round-robin tests on thickness measurement are now in progress in order to establish thickness limits for the proposed three classes or levels for proof test voltages.

The Subcommittee on Packings is continuing its study of a relaxation test for pure vulcanized compounds. It has obtained data on 1⅛ by ½-inch pellets of two 33R9 compositions at 70 and 100° C. obtained on the following machines: Beam machines of Goodrich and General Motors, Mare Island compressometer, Goodrich pneumatic machine, and the SR-4 Strain Gage.

Plans were announced for active work by the Subcommittee on Hard Rubber in the development of a series of eight new test procedures for asphalt composition battery containers, and a revision of the bulge test now in Method D 639.

The Subcommittee on Insulated Wire and Cable reported that specifications are in preparation for polyethylene insulated power cables and for butyl rubber insulation.

Wiseman Named Vice-President

Dr. Robert J. Wiseman, associated with the Okonite Co., Passaic, N. J., since 1921, has been appointed vice-president and chief engineer of the firm. A graduate of the class of 1912 at the Massachusetts Institute of Technology, Dr. Wiseman remained there until 1917 as a member of the teaching staff. In 1915, he received his doctor of science degree from the Institute. Subsequently, he served as an engineer with the Western Union Telegraph Co. and the National Conduit and Cable Co. He joined Okonite in 1921 as a research engineer, and rose to the position of chief engineer, the position he held at the time of his recent appointment. Dr. Wiseman is the author of many articles published in the electrical trade press and is widely known throughout the electrical industry as an authority on cable design and insulations. He has been active in national and international technical societies, including the AIEE, ASTM, the National Research Council and other organizations.

SPI Plans Annual Conference

The Annual National Conference of the Society of the Plastics Industry, Inc., will be held on October 18, 19 and 20 in Swampscott, Mass. Held in cooperation with the Harvard Business School, this conference will be restricted to members of the SPI. It is expected that 400 members will attend, representing the 539 plastics company members in the United States, Canada and 13 foreign countries. Morning and afternoon sessions are planned for the meeting. Morning sessions will be conducted by Harvard professors who will speak on such subjects as labor and pensions, production, executive development, marketing and advertising. Afternoon sessions will be technical in nature and will include topics pertinent to the plastics industry.

Introduces Tack Reducer

D-Tac, described as an efficient tack reducer for rubber compounds, particularly for highly loaded clay-cold rubber batches, is currently being marketed by the Polymel Corporation, 1800 Bayard St., Baltimore 30, Md. According to the company, D-Tac, while enabling the rubber to process without sticking to the mill rolls, seems to have no effect on the cure or subsequent physicals. Only a small percentage of the material is required to secure good processing, the amount depending upon the degree of tack in the compound.

NEW CORPORATION TO OPERATE REACTIVATED SYNTHETIC PLANT

A new corporation, the Kentucky Synthetic Rubber Co., has been formed by ten rubber companies to reopen and operate the Government-owned synthetic rubber plant at Louisville, Ky. The $7,000,000 installation was operated from 1942 to 1947 by the National Synthetic Rubber Corp., and has been maintained in mothball condition since that time by a crew under contract with the Minnesota Mining & Manufacturing Co.

Thomas Robins, Jr., president of Hewitt-Robins, Inc., of New York, N. Y., is president of the new corporation which will operate under contract with the Reconstruction Finance Corporation. George F. Goodyear is secretary and general counsel of Kentucky Synthetic while Leo Clifford is controller and assistant secretary. Both men are associated with Hewitt-Robins. Robert Eck, treasurer of the Goodall Rubber Co., Trenton, N. J., has been named treasurer of Kentucky Synthetic.

Participating Firms Named

Other participating firms, all outside the tire branch of the industry, and their representatives on the Kentucky Synthetic's board of directors, include Frank D. Hendrickson, president, American Hard Rubber Co., New York, N. Y.; J. H. Bierer, vice-president, Boston Woven Hose & Rubber Co., Cambridge, Mass.; Edward A. Callanan, president, Brown Rubber Co., Lafayette, Ind.; Oliver Vinnedge, vice-president, Dryden Rubber Division of the Sheller Manufacturing Co., Portland, Ind.

Also, Frederick B. Williamson, Jr., president, Goodall Rubber Co., Trenton, N. J.; John H. Matthews, vice-president, Raybestos-Manhattan, Inc., Passaic, N. J.; Everett Morss, president, Simplex Wire & Cable Co., Cambridge, Mass.; Frederick M. Daley, president, Sponge Rubber Products Co., Shelton, Conn., and J. W. Crosby, president, Thiokol Corp., Trenton, N. J.

Firestone Lends Assistance

This is believed to be the first time that Government has gone outside the tire industry to pick management from the rubber industry for the operation of a synthetic rubber plant. However, the larger rubber companies have loaned technical assistance and the Firestone Tire & Rubber Co., has been engaged by Kentucky Synthetic to conduct actual "demothballing" of the plant, which will include the installation of new machinery to meet new production techniues developed since the end of World War II.

The Louisville plant has a rated capacity of 30,000 tons of butandiene-styrene type synthetic rubber per year. All raw materials, and the crude rubber which will be produced, will be owned by the Government. The plant is expected to be back in operation by January 1, 1951.

Dr. Henry F. Palmer

Named Manager of Kentucky Synthetic Rubber Corp.

Dr. Henry F. Palmer, widely-known consultant to the rubber industry, has been named manager of the newly formed company. Dr. Palmer resigned his position as assistant director of the chemical laboratories of the Firestone Tire & Rubber Co. in 1947, after serving 21 years with the company, and entered private practice. From 1942 to 1944, Dr. Palmer had served with the Rubber Reserve Company as production manager for the synthetic rubber plants. During this period, he was on loan from the Firestone organization. Dr. Palmer holds degrees from several universities and is the author of many scientific articles.

Bay State Opens Rubber Highway

A five and one-half mile, four-lane "rubber" highway, said to be the longest of its kind in the world, was recently opened to traffic by highway officials of the State of Massachusetts. The new "rubber" highway is on the old Boston Post Road, now U. S. Route 1, and extends from the town of North Attleboro, Mass., south to the Rhode Island State line. It was laid over a patched concrete base at an approximate cost of $200,000. The road is constructed of a combination of asphalt and a new meltable rubber compound called "Surfa-Sealz" developed by the U. S. Rubber Co. Half-mile test strips were laid down last year in Massachusetts and have shown the ability to withstand wear in a remarkable fashion. According to state officials, current resurfacing plans call for more than 20 miles of rubber-asphalt pavement.

Hauser Leaves Heveatex Corp.

W. J. R. Hauser, who has been associated with the Heveatex Corporation of Melrose, Mass., as a vice-president for the past sixteen years, has resigned from that organization. He continues to make his headquarters at 155 East 47th St., New York 17, N. Y.

U. S. RUBBER'S FACILITIES ARE OUTLINED BY HUMPHREYS

The U. S. Rubber Co. has plowed back more than $102,000,000 in profits since V-J Day to expand and modernize plants and equipment. As a result, it is better prepared than ever before to meet the defense and civilian needs of the nation, according to a recent statement by Harry E. Humphreys, Jr., president of the company.

Mr. Humphreys also announced that the company had formed a production-planning committee to develop plans for speedy and efficient conversion to all-out production on short notice in the event of a general war. The committee is composed of the company's general managers and the director of research under the chairmanship of the executive committee's adviser on production.

"United States Rubber Company and the rubber industry in general are better prepared than in the last war to meet the needs of the nation," Mr. Humphreys said. "In 1941, we imported almost all of our rubber, and we had little stockpiled when the Japanese seized the plantations. Today we have a synthetic rubber industry capable of producing 940,000 tons a year and a growing stockpile of natural rubber. We also have the technical knowledge to switch quickly from natural to synthetic rubber if necessary."

Mr. Humphreys said his company, at the outbreak of World War II, could turn out about 35,000 tons of finished rubber products a month, and that today it can make about 46,750 tons, an increase of 31 per cent. In addition, the company has greatly increased and modernized its chemical and textile facilities.

Rubber Production in Sweden

For several years the Swedish Agricultural Station at Svalov, in southern Sweden, has been trying to produce rubber from dandelions. The first report of these experiments, recently published, indicates a very high degree of success. Some bicycle tires and a quantity of tennis balls, all of the highest quality, have been produced from dandelion rubber. It is stated that from early experiments in 1942 a rubber content of 5.7 per cent was obtained from the original material and that it has become possible to produce a dandelion type yielding 12.5 per cent rubber content. Indications are that the rubber content can be further increased. It is said that there are excellent prospects for the cultivation of rubber dandelions in Sweden as they grow very well in the far north and thrive in moss and moor soil. According to calculations, 1 hectare (2.47104 acres), of rubber dandelions would yield 150 kilograms (1 kilogram = 2.2046 pounds) of rubber or about 30 automobile tires per year.

"Hommage de la Ville de Paris a Francois Fresneau" is the title of a booklet available from the Institut Francais du Caoutchouc, Paris, France. It includes various talks made on the occasion of naming a street in Paris after Fresnau, often referred to as "the father of rubber."

GOODRICH PRESIDENT PROPOSES HALT IN RUSSIAN RUBBER SALES

Nations that control, or have great influence in the rubber producing areas of the Far East, should discontinue the sale of crude rubber to Russia and its satellites, John L. Collyer, president of the B. F. Goodrich Co., stated recently. "Crude rubber, a vital strategic material, is being received in diminishing tonnage in the United States although this nation is the world's largest consumer of rubber of all types. Meanwhile, Russia has been buying substantial quantities of crude rubber since the close of World War II," Mr. Collyer declared.

"Principal supplier of rubber to Russia has been, and continues to be, British Malaya and Indonesia and other producing areas also unquestionably supplying rubber for stockpiling and consumption behind the iron curtain. It is significant that nations controlling 80 per cent of the world's crude rubber are either beneficiaries of the Marshall Plan or are today receiving American aid through governments that are sponsored by the United States. These nations are standing with the United States in the action of the United Nations in Korea and have pledged moral, and to some extent, material assistance, to our nation and our armed forces in this present war against communism.

Distribution of Crude Rubber

"Recent statistics on the distribution of crude rubber show, for example, that in July of this year only 27,000 tons of the 102,000 tons shipped from Malaya came to this country. Our country, which normally consumes 55 per cent of the world's new rubber, received 55 per cent of Malayan rubber in 1940 before World War II and 37 per cent for the first six months of the current year. The July, 1950, figure of only 27 per cent emphasizes the urgency of our present rubber position. The United States, at the present rate of consumption, will this year require approximately 1,200,000 long tons of new rubber to fill military and essential civilian requirements, including both crude and synthetic rubber.

"Due to our nation's present inability to obtain crude rubber in sufficient quantities for necessary stockpiling and to continue to fill the legitimate needs of American consumers, it may be mandatory for government to exercise controls on rubber usage. Diversion of rubber supplies from Russia to the United States would be in the highest interest of all free people at this critical period.

"On the economic side, Russian purchases of crude rubber are largely paid for in the soft currencies of the countries concerned. Nations engaged in crude rubber production would improve their dollar position through the sale of additional supplies of crude rubber to the United States while, at the same time, making a definite contribution to their own security and to ultimate victory in Korea. Such dollar earnings would lessen the drain on American taxpayers, and make more of our financial resources available to win the war," Mr. Collyer concluded.

Coming Events

Sept. 19. A.S.M.E. Rubber & Plastics Div., Fall Meeting, Hotel Sheraton, Worcester, Mass

Sept. 29. Northern Calif. Rubber Group, Claremont Hotel, Berkeley, Calif.

Oct. 6. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit.

Oct. 11-13. Rubber Division, A.C.S., International Rubber Meeting, Hotel Cleveland, Cleveland.

Oct. 16-20. Technical Committee 45 on Rubber, International Organization for Standardization, Hotel Mayflower, Akron, Ohio.

Oct 16-20. National Safety Congress and Exposition, Chicago.

Oct. 17. Buffalo Rubber Group, Hotel Westbrook, Buffalo, N. Y.

Oct. 18-20. Society of the Plastics Industry, Annual Conference, Swampscott, Mass.

Oct. 20. N. Y. Rubber Group, Henry Hudson Hotel, New York.

Oct. 20. Boston Rubber Group, Somerset Hotel, Boston.

Oct. 20. Akron Rubber Group, Hotel Mayflower, Akron.

Oct. 24. Washington Rubber Group, Annual Dinner, Hotel Washington, Washington, D. C.

Nov. 10. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

Nov. 26-Dec. 1. A.S.M.E., Annual Meeting, New York, N. Y.

Dec. 8. Detroit Rubber & Plastics Group, Xmas Party, Detroit-Leland Hotel, Detroit.

Dec. 11. Northern Calif. Rubber Group, Xmas Party, The Willows, Orinda, Calif.

Dec. 15. N. Y. Rubber Group, Xmas Party, Henry Hudson Hotel, New York.

Dec. 15. Boston Rubber Group, Xmas Party, Somerset Hotel, Boston.

Dec. 19. Buffalo Rubber Group, Xmas Party, Elks Club, Buffalo, N. Y.

Jan. 26, 1951. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

Feb. 28-Mar. 1-2, 1951. Rubber Division, A.C.S., Spring Meeting, Washington, D.C.

New Goodrich Defiance Tire

B. F. Goodrich Co., Akron, Ohio, has announced the production and sale of a new "Defiance" tire. The new tread design has a center "safety zone", seven full ribs, zig-zag anti-skid blocks, is wide and flat and has buttress built shoulders. The company's "Rythmic Floating Cords" are used in the construction of the new "Defiance" tire.

PLASTICS EDUCATION PROGRAM RECOMMENDED BY SPI COMMITTEE

The plastics industry has long recognized the necessity for advanced study in the problems peculiar to plastics in science and engineering curricula of colleges and universities. As a result, the committee on plastics education of the Society of the Plastics Industry, Inc., has prepared for publication a program for plastics education in science and engineering. It recommends:

1. That colleges and universities provide all science and engineering students with a general knowledge of the nature of high polymers and their importance in every day affairs by integrating an elementary discussion of their properties in certain existing courses; for example, general physics, general chemistry, elementary organic chemistry, mechanics, strength of materials, materials of construction, materials testing, and possibly descriptive geometry and machine drawing or machine design.

2. That colleges and universities provide interested undergraduate students with an opportunity to acquire specialized and detailed knowledge of plastics by offering one or more elective courses; for example, chemistry and technology of high polymers, and plastics engineering.

3. That graduate schools offer selected students in science and engineering the means of obtaining advanced research training in plastics by setting up graduate curricula consisting of elective courses in high polymers, a selection of suitable cognate courses, and research projects.

Prospects for Employment

Students are warned that successful completion of this program does not necessarily guarantee them employment in the plastics industry. However, it is emphasized that the industry prefers to employ persons with broad specialized academic training and that this program is designed to put them in a much better position to successfully qualify for positions in the industry.

The committee also emphasizes that the plastics field is one in which changes are constantly taking place, that developments are proceeding at a rapid pace, and that the entire situation is extremely fluid.

The SPI Committee on Education feels that this recommended program for plastics education will be of material benefit to educational institutions throughout the country. Copies of the program in booklet form are available from the Society of the Plastics Industry, Inc., 295 Madison Avenue, New York 17, New York.

Building New Snell Laboratories

Foster D. Snell, Inc., New York 11, N. Y., has announced the letting of contracts for the first unit of their laboratories in Bainbridge, N. Y. Construction will be of concrete and brick on approximately one acre acquired for this purpose. The present structure is a single wing of a unit providing for four wings with extensions. The project does not envisage any change of company activities in New York at present.

NEW YORK GOLF TOURNAMENT ATTRACTS FIELD OF OVER 140

Approximately 160 members and guests attended the Annual Golf Tournament of the New York Rubber Group, held this year on August 8 at the Baltüsrol Golf Club in Springfield, N. J. More than 140 players participated in the tournament, with numerous prizes being awarded for various events.

Low gross honors for members went to F. Salamon (Binney & Smith), with a 76; H. Pryor, with an 82, and J. Breckley (Titanium Pigment), with an 84. Low gross honors for guests went to Wes Curtis (Naugatuck Chemical), with a 74; L. Sadick (Ross & Roberts), with an 80, and V. Lake (Pioneer Latex).

The three winners in the putting contest, in order, were P. W. Reed (Bishop Gutta-Percha), F. Pechal (Manhattan Rubber), and Ken Soule (Manhattan Rubber). Winners in the kicker's handicap included E. H. McGee, C. White, T. Callahan, and J. Rines. Special awards were also presented to a long list of players for securing birdies on various holes.

The committee in charge of arrangements included Steve Corrigall (Vanderbilt) as chairman, and Tom Callahan (Witco Chemical), Joe Breckley (Titanium Pigment), Wally McComb (Rubber Corporation), E. B. Curtis (Vanderbilt), and A. H. Eufer (Vanderbilt).

Seiberling Joins Copolymer Corp.

Seiberling Rubber Co., Akron, Ohio, has joined the Copolymer Corp., which operates a Government synthetic rubber plant at Baton Rouge, La. Copolymer directors have elected the Seiberling firm a member "with equal participation" with other owners. Organized in 1942, the Copolymer Corp. is owned by eight smaller tire manufacturers and Sears, Roebuck & Co. It began producing synthetic rubber in 1943, and in February, 1948, was the first plant to produce "cold rubber." H. P. Schrank, Seiberling vice-president in charge of production, will represent the firm on the Copolymer board. Ralph T. LaPorte, chief chemist, will be the company's technical representative. A. L. Freedlander, president of the Dayton Rubber Co., is president of the Copolymer Corp. Other firms, besides Seiberling, Dayton and Sears, Roebuck, which own the company, are: Armstrong Rubber Manufacturing Co., Armstrong Rubber Co., Gates Rubber Co., Lee Rubber & Tire Corp., Mansfield Tire & Rubber Co., and Inland Rubber Co.

Philadelphia Holds Outing

The Philadelphia Rubber Group held its annual summer outing on August 18, at the Cedarbrook Country Club, Mount Airy, Penna. Approximately 130 members and their guests were in attendance. The outing featured a program consisting of a handicap golf tournament, cards and a banquet. Door prizes were awarded to all persons attending the banquet. In addition, golf prizes were awarded to the seven low handicap winners. Prizes were also awarded for birdies and eagles. A total of 60 members entered the golf tournament.

O'Neil Refutes Pearson Charges

In newspaper advertisements published about the country, William O'Neil, president of the General Tire & Rubber Co., refuted recent charges made on Drew Pearson's radio time concerning General Tire's efforts to purchase a surplus synthetic rubber plant in Akron. Mr. O'Neil, in the advertisement, said that "over the air such phrases as 'questionable sale' . . . etc., made it sound as if the General Tire & Rubber Co. had somehow connived to purchase, for less than its value, a synthetic rubber plant from the Government and turn it over to the production of plastics." Mr. O'Neil said that the plant in question has been idle and deteriorating for five years. General Tire's bid of $2,214,000 was 65% above the Government's own fair value estimate of $1,375,000, and far above other bids. General agreed to convert to synthetic rubber immediately upon notice of the Government, or to give the Government the option of repurchasing the plant at actual cost with no profit to the rubber company. Finally, the plastic mentioned on the broadcast is a new type needed for military purposes, some of which are strictly confidential, Mr. O'Neil concluded. As far as can be determined, the Government is presently reviewing the situation.

Expansion of Kismet Products

Kismet Products, Inc., of Painesville, Ohio, which was organized in February, 1949, with five employees, now employs a total of 30 persons in the manufacture of extruded rubber products. The company produces tubing, channels, and special die run strips to customer specifications. It also manufactures cut washers and spliced gaskets for the automotive, washer, sweeper, refrigerator and barrel trade. Production started on July 1, 1949. H. A. Walker is president of the firm with George Bay, Jr., as vice-president. Frank Bay serves as treasurer while Veron Bowyer is secretary. Joseph Koston is the factory manager.

Playground Paved With Rubber

Some 3,500 square yards of playground space at Margaret Park School in Akron, Ohio, have been surfaced with a one-half inch layer of ground rubber which was bound to a slag base by an asphaltic emulsion. Spokesmen for the Akron Board of Education emphasized that the rubber playgrounds are not like rubber streets. The rubber streets are as hard as concrete but rubber playgrounds give a slight bounce. One type of rubber furnished for the playground was supplied by the Firestone Tire & Rubber Co., and is light in color. The other, almost black, was provided by the Goodyear Tire & Rubber Co. The Margaret Park School surfacing consists of the conventional slag base, stabilized with asphalt and given a coating of slag. This top surface is treated with an asphalt emulsion over which is spread ground rubber at the rate of seven pounds per square yard. The rubber particles are forced into the asphalt-coated surface by a roller. As the asphalt cools, the rubber adheres to the slag, offering a carpet-like surface. The loose rubber is swept away and the playground is ready for use. If the new rubber surfacing is successful, it will be applied to all Akron playgrounds now covered by asphalt. This can be done at minimum expense because the present asphalt base can be used.

Detroit to Hear Winkelmann

Dr. H. A. Winkelmann, technical director of the Dryden Rubber Division of the Sheller Manufacturing Co., will be the principal speaker at the Fall Meeting of the Detroit Rubber & Plastics Group, to be held on Friday, October 6, at the Detroit-Leland Hotel in Detroit, Mich. Dr. Winkelmann will discuss "Weather Aging of Automotive Rubber." Another feature of the meeting will be the showing of many colored movies and slides taken at the recent summer outing of the Detroit Rubber Group.

The photographs above depict some of the members of the New York Rubber Group who participated in the recent golf outing. The photographs were taken by Tom Callahan of the Witco Chemical Co.

SIX-MONTH CASING PRODUCTION TOPS 1949 TOTALS BY 6 MILLION

A total of 45,525,149 passenger and truck and bus casings were produced in the first 6 months of 1950, topping the 39,456,981 casings produced in the first half of the preceding year, the Rubber Manufacturers Association reported recently. In the first six months of 1950, 38,637,693 passenger and 6,887,456 truck and bus casings were produced, contrasted with 33,111,610 and 6,345,371 casings, respectively, produced in the first half of 1949.

Casings shipped in the first half of 1950 totaled 45,171,893 units, including 38,378,629 passenger casings and 6,793,264 truck and bus casings. In the first six months of the previous year a total of 37,022,273 casings were shipped, including 31,263,264 passenger and 5,759,009 truck and bus casings. As of June 30, 1950, there were 10,762,063 casings on hand, including 8,987,234 passenger casings and 1,774,829 truck and bus casings. On July 30, 1949, there were 13,135,434 casings on hand, of which 10,618,506 were passenger casings and 2,516,928 were truck and bus casings.

Tubes produced in the first six months of 1950 totaled 38,567,118 units, while 37,896,123 units were shipped. In the first half of the preceding year, 34,100,801 tubes were produced and 31,277,383 were shipped. At the end of June, 1950, there were 11,248,213 tubes on hand against the 12,306,030 tubes on hand as of June 30, 1949.

Casing Production in June

In June, 1950, a total of 8,480,266 passenger and bus and truck casings were produced, including 7,310,890 passenger and 1,169,376 truck types. In the preceding month, 8,629,087 casings were produced of which 7,369,190 were passenger casings and 1,259,897 were of the truck and bus variety.

A total of 10,202,211 casings were shipped in June of which 8,804,091 were passenger casings and 1,398,120 were truck and bus casings. In May, 8,521,141 casings were shipped, including 7,276,860 passenger casings and 1,244,281 truck and bus casings.

The RMA also reported that 7,536,925 tubes were produced during June, against the 7,089,327 tubes produced in May. A total of 8,458,809 tubes were shipped during June, compared with the 6,687,925 tubes shipped in the previous month. As of June 30, there were 11,248,213 tubes on hand, while on May 31, there were 12,109,933 tubes on hand.

New Meyercord Decalcomania

Meyercord Co., 5323 W. Lake St., Chicago 44, Ill., has developed a new type of decalcomania for full-color decoration of brand marking on canvas footwear, sporting goods and outdoor clothing. An adaptation of the type V Elasti-cal commonly used for trademark identification on vinyl surfaces, the new transfer may be applied quickly and easily to canvas or duck either by hand or steam press at production line speeds. Forming an edgeless part of the canvas surface, to stretch and breathe with the fabric, the new decal is washable, sunfast and permanent.

Tire Profit Rate

The rubber industry was back on a pre-war operating basis through the year of 1949 according to a study of profits recently completed by the Federal Trade Commission. Last year's rate of profit for 16 firms making tires and tubes was 9%, which is the same rate that was recorded in 1940. Tire and tube manufacturing profits were among many which tended lower in 1949 than in the year before. The rate of return for the tire industry in 1948 was 13.8% while the 1947 rate was 15.3%. These rates were determined after all taxes were settled.

LABOR NOTES

Negotiations for another round of wage increases in the rubber industry are under way at this writing. Representatives of the U.R.W.A. and Goodrich started negotiations in Cleveland on August 30 and talks with Goodyear were scheduled to start in the same city on September 6. Basic requests are understood to have included a 25-cent-an-hour general increase and pay adjustments to correct inequities within plants, between plants, and between geographical areas. The union failed in its attempt to arrange negotiations on a Big Four basis.

Pacts were signed on August 1 by Seiberling Rubber and the Seiberling local on a pension and welfare program and a one-year extension of the company-wide contract with amendments. The pension and welfare program includes $100 minimum pensions for 65-year-old workers with 25 years of service and modified disability retirement features that pay $50 monthly to workers 60 years or older with at least 15 years of service. The amended working agreement includes a wage reopening clause.

A wildcat strike affecting some 1600 production workers shut down the Passaic, N. J., plant of U. S. Rubber from August 10 to 15. With the return, negotiations were resumed on a new contract. The old agreement expired on July 1, but was carried over to August 22 by consent of both parties. Union leaders described the stoppage as unauthorized, but said the union had a number of grievances, chiefly involving job assignments.

About 3500 production workers at the Ball Band plant of U. S. Rubber in Mishawaka, Ind., ended a six-day strike on August 6, accepting an agreement reached between union and company negotiators. Workers walked off their jobs in a dispute involving job merit systems for older employees. The agreement concerned only settlement of complaints against the merit system and seniority rights, and did not involve wages.

NATURAL PRODUCTION IN JUNE SETS HIGHEST MONTHLY RECORD

World production of natural rubber reached 157,000 long tons in June, the highest monthly figure ever recorded, according to estimates of the Secretariat of the Rubber Study Group, the U. S. Department of Commerce reported recently. Output of natural in June exceeded consumption by 20,000 tons. For the first six months of the year, production was estimated at 822,500 tons which was 125,000 tons, or 17.9 per cent, greater than in the corresponding period of 1949. Normal seasonal factors point to an annual output for 1950 of more than 1,700,000 tons.

Rubber exports from Indonesia in June were calculated by the Secretariat at 65,631 tons, only 77 tons short of the all-time record posted in September, 1941. For the first six months of 1950 these exports totaled 275,551 tons, an increase of 89,333 tons, or 48.0 per cent over January-June, 1949.

Continuing the record pace of the previous month, world new rubber consumption was again estimated at 190,000 tons in June, and consisted of 137,500 tons of natural and 52,500 tons of synthetic. The synthetic figure was the highest since May, 1947. For the first six months of this year, new rubber consumption was estimated at 1,047,500 tons (792,500 natural, 255,000 synthetic) as against 970,000 tons (732,500 natural, 237,500 synthetic) in the same period last year. Included in these consumption figures are estimated imports of natural rubber into Russia amounting to 5,750 tons in June, 27,500 tons in January-June, 1950, and 67,500 tons in January-June, 1949.

Synthetic rubber production in June was estimated at 43,500 tons, making the January-June total about 230,000 tons, as compared with 235,633 tons in the same period of 1949. World stocks of natural rubber, excluding Russian stocks, and excluding Government stocks in the United States, the United Kingdom, and France, were placed at 715,000 tons as of the end of June, down 10,000 tons from January 1. Stocks in consuming countries were estimated at 247,500 tons, down 12,500 tons from January 1. World stocks of synthetic rubber were estimated at 75,000 tons, down 35,000 tons since the beginning of the year.

ACS Forms High Polymer Unit

The American Chemical Society has announced the formation of the Division of High Polymer Chemistry. Professor Carl Shipp Marvel, of the University of Illinois, World War II leader in the development of synthetic rubber and a former president of the Society, has been elected first chairman of the new division which was scheduled to hold its initial sessions in Chicago, Ill., on September 4 to 6 during the Society's 118th national meeting. Professor Herman F. Mark, director of the Polymer Research Institute at the Polytechnic Institute of Brooklyn, is secretary of the division, which becomes the twentieth of the scientific and technical groups organized within the ACS.

Hycar-Quilon Printing Paste

A radical method of screen printing Coronized Fiberglas fabrics has made possible the recent development of new colorful drapery materials by the Owens-Corning Fiberglas Corp. Called the Hycar-Quilon method, the process is similar in certain respects to water dispersion type resin-pigment systems widely used in printing cottons, rayons, etc. The Fiberglas drapery fabrics are first Coronized in Owens-Corning's plant in Ashton, R. I. Here they undergo high temperature treatment which renders the fibers soft and pliable and also permanently sets the crimp which makes them wrinkle resistant. A light coating of cationic agent is then applied which acts as a lubricant and protective agent for the bare glass fabric and also prepares the surface for printing. The Hycar-Quilon paste is a liquid dispersion with the consistency of conventional workable pastes to which printers are accustomed. Function of the Hycar is to serve as a binder for pigments which are subsequently added to the paste. The Hycar latex is brought to proper consistency by the addition of a thickening agent. After printing, the goods are cured at 300° F. for approximately one-half minute, then immersed for 15 seconds in a dilute solution of a special after treatment, and finally dried at 250° F.

Goodrich Glacial Acrylic Acid

What is said to be the first commercial production of glacial acrylic acid, a derivative of beta-propiolactone, has been announced by the B. F. Goodrich Chemical Co., marking the entrance of the company into the acrylic field. Manufacture of the new lactone derivative will begin shortly at the company's Avon Lake general chemicals plant, and will be available in ton lots from a semi-works unit. The basic chemical, beta-propriolactone, was introduced by Goodrich Chemical in 1947. Because of its extreme chemical activity, beta-propriolactone is the basic raw material for the manufacture of numerous synthetic organic chemicals of which glacial acrylic acid is only one. Glacial acrylic acid has a moleculer weight of 72.02. It is a clear, colorless liquid boiling at 142° C. at 760 millimeters pressure. It melts at 12-13°C., has a specific gravity of 1.048 grams per cubic centimeter at 20° C., and a refractive index of 1.420. Chemically it is extremely reactive and polymerizes rapidly in the presence of oxidative catalysts. It will be available in the glacial or "dry" form, with over 97% purity, and containing less than 1% water.

Rubbatex Synthetic Polymer

Rubba, Inc., 1015 East 173 St., New York, N. Y., has announced the development of a new polymer, "Rubbatex," for replacing and extending natural rubber latex. The product is said to be suitable for adhesives, coating, dipping, waterproofing and as a binder. "Rubbatex" can be used in place of natural rubber latex or can be mixed with natural rubber latex to make the same go two or three times as far, the company states.

Named Cycle Tire Manager

K. F. Morlen

K. F. Morlen, formerly general service manager for the Tire Division of the U. S. Rubber Co. at Detroit, Mich., has been appointed manager of the Cycle Tire Department of the division with headquarters in Detroit. Mr. Morlen was born in Corydon, Ind., and attended De Pauw University where he received a B. S. degree in engineering in 1931. Following his graduation, he took a two year course in advanced engineering at the General Motors Institute. His career with U. S. Rubber began in 1934 when he entered two years practical training in tire engineering and service. Mr. Morlen then served as a field engineer for two years until 1938, when he became a sales representative. In this field he served as district sales manager at Detroit and Chicago, Ill. He was appointed general service manager in 1949. Mr. Morlen served in the Armed Forces during the war. He was commissioned in charge of tire maintenance for the Naval Air Force. In his new position, Mr. Morlen will be assisted by Larry Goodrich, who previously served as assistant manager of cycle tires.

Goodyear Modernizes Power Plant

A $5,000,000 power house modernization program which will increase electrical distribution facilities and at the same time virtually eliminate discharge of fly-ash from company stacks, has been announced by the Goodyear Tire & Rubber Co., Akron, Ohio. Work on the program was started on August 1, at Plants 1 and 2 in Akron. The initial step in the program is the installation of fly-ash collectors on high pressure boilers, and the replacement of low pressure boilers at both plants with high pressure equipment. Installation of this equipment will be supplemented by additional electrical generating and distribution equipment. The fly-ash, instead of passing from the power house stacks, will be deposited in hoppers where it will be forced by compressed air to silo-like storage bins. The material will then be dampened with water and shipped to by-products concerns for use in building blocks and road surfacing materials. Present low temperature boilers will be held in standby condition by the company after the new equipment is placed in operation.

DuPont Laboratory Safety Record

Employees of the Akron laboratory of the Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., have worked without a time-losing injury since the laboratory opened in November, 1946, it was recently announced. Emil H. Krismann, manager of the laboratory, said that during that time laboratory employees have compiled a no-accident record of more than 1,300 days, or about 114,000 man-hours. The laboratory has been awarded the general manager's award from the company with safety prizes for each employee. In addition, the laboratory has received a trophy from the National Safety Council signifying that the unit was among the winners in its 1949 safety contest, and a council pennant symbolizing the company's receipt for seven consecutive years of the council's award for "distinguished service to safety."

Expands Polyvinyl Facilities

B. F. Goodrich Chemical Co., Cleveland 15, Ohio, is planning a substantial expansion of its general chemicals plant at Avon Lake, Ohio, for the production of Geon polyvinyl chloride resins. The expansion will increase the company's productive capacities in an effort to meet future military needs and the demands of industry. In World War II, vinyl resins were high-priority materials used as flameproof insulation and for signal equipment, protective coatings of various types and other uses. The new plant, to be completed in mid-1951, will cover seven acres on the company's tract at Avon Lake, twenty-two miles west of Cleveland. It will consist of two buildings—a three-story process building with 40,000 square feet of floor space and a warehouse.

Display Dornbusch Patterns

Dozens of the embossing patterns and grains which form part of the 30,000 collection of Dornbusch & Co., Krefeld, West Germany, were displayed by Dr. Paul Dornbusch at a press conference held at the Statler Hotel in New York City on August 24. Several new methods of applying specialized surface finishes to a wide variety of materials were outlined by Dr. Dornbusch including one applicable to rubber and plastic surfaces which, based on a study of light reflections, creates the illusion of depth on a flat surface. Most of the effects are obtained with the use of embossed rolls made by the Dornbusch concern. The F. A. Ringler Co., of New York City, represents the German concern in this country.

Goodrich Opens Reclaim Plant

B. F. Goodrich Co. has announced the reopening of a reclaimed rubber plant in Akron, Ohio, which is scheduled to be in full production by early fall. Company officials noted the current boom in reclaimed rubber as a determining factor in reopening the plant. Recent government restrictions on the use of natural and synthetic rubbers, combined with the high price of natural, are responsible for the reclaim boom which may boost production to 300,000 long tons a year, they said.

REPORT ON THE INITIAL MEETING OF NEW ASTM RUBBER COMMITTEE

As previously reported, the activities of the former Crude Rubber Committee of the Division of Rubber Chemistry were taken over several months ago by Committee D-11 on Rubber and Rubberlike Products of the American Society for Testing Materials. To handle these activities, Subcommittee XII on Crude Natural Rubber was organized, with Norman Bekkedahl of the National Bureau of Standards as chairman.

The initial meeting of Subcommittee XII on Crude Natural Rubber was held in Detroit, Mich., on April 19, 1950, during the 56th Meeting of the A.C.S. Rubber Division. Present at the meeting were the following members and guests of the subcommittee:

C. O. Miserentino (Dunlop), W. D. Merritt (Gates Rubber), J. J. Hoesly (Goodyear), Wm. B. Dunlap, Jr. (Lee Rubber), R. T. LaPorte (Seiberling), L. G. Mason (Goodrich), H. W. Howard (Rome Cable), G. L. McCutchen (Rome Cable), L. M. Baker (General Tire), E. M. McColm (U. S. Rubber), E. J. Giolito (Industrial Tape), C. D. Humphreys (General Cable), G. C. Maassen (Vanderbilt), L. Mullins (British Rubber Producers' Research Association), D. D. Wright (Hood Rubber), B. S. Garvey (Sharples Chemicals), and Mr. Bekkedahl.

Because of the importance of the new subcommittee's work to both producers and consumers of rubber, we are reproducing below the minutes of the initial meeting in full:

Minutes of the Meeting

The Chairman opened the meeting by describing the need for improving and developing methods for the physical and chemical testing of crude natural rubber in order to obtain a better evaluation of the raw material.

The determination of the quantities of copper and manganese in raw rubber is important, especially for the rubber which is to be stockpiled or not used for a long period of time. Because methods for the quantitative estimation of these metals are being studied by other subcommittees (VII and XI) of the Committee D-11, it was thought that we could rely on their recommendations, at least for the present. A satisfactory method for the determination of cleanliness of rubber would be extremely valuable but probably quite difficult to develop. A uniform rate of cure and reproducible processibility in rubber are also desirable.

Mr. Maassen brought out the fact that the National Bureau of Standards has under consideration a proposal to purchase about 25,000 pounds of crude natural rubber which is extremely uniform in its physical and chemical properties. This rubber will probably be put into containers holding about 25 pounds each, and sold as a standard natural rubber. The A.S.T.M. Special Committee on Standard Samples in Committee D-11 has been requesting the establishment of such a standard.

Mr. Mullins spoke for a few minutes on the work being done in England to improve the grading system of rubber. The British make use of a strain tester, and for determining rate of cure they measure the time to minimum strain. They are also planning to grade the rubber on the basis of Mooney viscometer measurements.

Dr. McColm, who recently returned from a stay in the Far East, then spoke for a few minutes on the situation of quality-rubber production at the plantations. The rubber producers have not been fully informed as to what qualities are wanted, but will do their best in supplying rubber with the required properties when they have been so informed. The various rubber producers from different countries of the Far East have joined together to form a technical committee to study the problems of rubber grading. Dr. McColm is a member of this committee. The French in the Far East have already introduced the procedure of marking the rubber bales as to the physical properties of the rubbers, and other countries are about to do likewise. In determining the physical properties of vulcanizates from the natural crude rubbers the A.C.S. formula has universally been used. More laboratories are at present being installed for the testing of rubber at the source of supply.

General discussion was then started on pros and cons of the various testing methods which might be introduced. Dr. McColm stated that in spite of the fact that the T-50 test is an excellent method for measuring the rate of cure, it is a difficult test to manage in the tropics because of the extremely high humidity. The industrial representatives felt that at least until they had had some experience with the National Bureau of Standards strain-tester it was preferable to talk in terms of modulus. For rate of cure they would like to measure the time required to reach maximum modulus, which is practically equivalent to what the British are measuring (time to minimum strain). This time is dependent on the three vulcanization parameters measured with the NBS strain-tester—namely time of incipient cure, rate constant, and inherent stiffness factor—and the rate of reversion of the rubber. There was general agreement, however, that maximum tensile strength was not very important.

Since about 98% of all rubber articles are produced from loaded rubber stocks most of the rubber technologists seemed to favor a loaded stock rather than a pure gum stock for test purposes, especially now that the National Bureau of Standards has a standard carbon black. This loading of the formula, however, has the disadvantage of adding another variable and of diminishing the differences in physical properties of the rubbers being tested.

A motion was made by Dr. McColm and seconded that since all the testing data available in the Far East have been obtained using the A.C.S. formula the committee adopt this formula as a temporary standard. The motion was passed. In the discussion, however, Mr. Maassen brought out the fact that, as already mentioned, the A.S.T.M. has a Special Committee on Standard Samples under the chairmanship of A. E. Juve of Goodrich, whose purpose it is to study and make recommendations regarding compounding formulas for various purposes. This committee is recommending a gum stock recipe which it believes to be superior to the A.C.S. formula for certain purposes. It was suggested that Mr. Juve be invited to appear before our next meeting and present that data and the recommendations of his committee on the compounding formulas.

A motion was made by Dr. McColm and seconded that the organizations of the producers of natural rubber be advised that it is the consensus of this A.S.T.M. Crude Natural Rubber Committee that the American consumers of rubber prefer at the present time to have the rate of cure of natural rubber based on the length of time required to reach maximum modulus (at an elongation of 500 or 600%) for a vulcanizate compounded according to the A.C.S. formula and cured at 20 pounds per square inch steam pressure, and that this maximum modulus also be reported. The rate of cure is to be (1) fast; (2) medium; or (3) slow; and the modulus value is to be (1) high; (2) medium; or (3) low. The limits are not as yet established. The motion was passed. It was agreed, however, that the rubber consumers of this country do not wish to be unreasonable in setting their specification limits too high for these properties. They would like to have suggestions and cooperation from the rubber producers in arriving at values that would be acceptable to both parties.

It was decided that for the present it would be desirable to grade by physical testing only the rubbers numbered 1's or 2's. The 3's and 4's could be added to the testing program later.

A motion was made by Mr. Maassen and was seconded that the organizations of rubber producers be advised also that the American rubber industry wants clean rubber in all the proposed grades. Motion passed.

A motion was made by Dr. McColm and was seconded that copies of the minutes of this meeting be sent to the various rubber research stations, and that it be urged that all these stations send copies of all important results of their data on the testing of crude rubber (tensile, modulus, rate of cure, viscosity, etc.) to this committee for study. These data are to be used in determining what uniformity may be expected in raw rubber and will be a great aid in determining the values for limits in specifications. Motion carried.

It was decided that this committee not set up a testing study at present. Time would probably be saved by first studying all the available data so that none of it might be duplicated. It is hoped that these data will be available soon so that reports on them may be presented at the next meeting, which will probably take place during the A.S.T.M. Meeting in Atlantic City, June 28-30, 1950.

It was the general understanding that all the above recommendations are, of course, tentative and may be altered at any time.

Norman Bekkedahl, *Chairman*

RUBBER PLAYS IMPORTANT ROLE IN CLOTHING ITEMS USED BY DEPARTMENT OF DEFENSE FOR SPECIAL DUTIES

Rubber plays an important role in strange, new types of clothing adopted by the U. S. Department of Defense for the comfort and survival of those exposed to the rigors of extreme heat and cold, deep sea training, and high altitude flying. The three items of clothing depicted above are among those utilized for such purposes.

On the left, a soldier tests a regenerating respirator attached to an arctic mask. The respirator, designed by the Quartermaster Corps and intended for work with a parka, is made of soft rubber and fits snugly around the nose and mouth. The respirator has metal wool in the lower portion. This retains heat from the exhaled breath and by releasing it to the inhaled air, protects the lungs and conserves body heat.

In the center is seen one of the "Frogmen" of an underwater demolition team of the navy dressed in a nearly watercolor green rubber suit. The uniform is one solid piece, with the opening in the back fastened by a brass clamp to hold out water. The black tabs on the head and chest allow the exhaust of air if the men are required to go any depth under water. The mask worn in the photograph is for underwater vision only and the swimmer must come to the surface for air. The swimming fins shown are of great assistance for long swims.

At the right, a U. S. Navy diver is shown wearing the diving suit used for rescue-salvage operations. The 56-pound rubberized canvas suit is supplemented with an 85-pound belt, a 54-pound helmet, and diving shoes weighing 25 pounds a pair. All three illustrations are official Department of Defense photographs.

Halocarbon Stabilized Polymers

Halocarbon Products Corp., 2012 88th St., North Bergen, N. J., has announced quantity production of stabilized low polymers of chlorotrifluoroethylene in the form of oils, greases, and waxes. Called Halocarbons, these products contain only carbon, fluorine, and chlorine, and are completely inert towards all corrosive agents including acids, alkalis, salts, and oxidizing agents, wet or dry. Halocarbons are said to be unaffected by prolonged heating in air at 480° F. Of interest to plastic fabricators is the use of liquid and solid Halocarbons as softeners for chlorofluorocarbon plastics in molding and coating operations. The addition of Halocarbons yields a molding mix which can be readily melted and formed without the decomposition usually experienced in fabricating the pure plastic.

DuPont Akroflex F Antioxidant

The Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., has announced a new flex-resisting antioxidant, Akroflex F. The new product is said to have important advantages over conventional antioxidants and in efficiency is almost equal to Thermoflex A. The melting point of Akroflex F is high enough to prevent caking or packing in storage, yet is low enough to assure excellent dispersion. Comparison between Akroflex F and Thermoflex A indicates that, for all practical purposes, the two antioxidants are equally effective.

Gulf Catalytic Cracking Unit

Gulf Oil Co., Pittsburgh, Penna., has awarded a contract to the M. W. Kellogg Co. of New York, N. Y., for the construction of a 60,000 barrel per day fluid catalytic cracking unit at the Gulf refinery at Port Arthur, Texas. The anticipated output of the plant will be approximately 20% greater than that of any similar installation in operation or construction. The new cracking unit will produce ingredients for synthetic rubber, automotive and aviation gasolines, and fuel oils. It is scheduled for completion during the late summer or early fall of 1951. Cost of the addition, with auxiliary equipment necessary for its operation, will be approximately $8,000,000. The new plant will be virtually automatic in operation and will embody the latest design features. It will cover 148,400 square feet of land and at its highest point will approach the height of a 20-story building. Every phase of the process will be regulated by electric or pneumatic controls.

Tuck Taffeta Ribbon Adhesive

Technical Tape Corp., New York 53, N. Y., has announced an important innovation in the packaging field, Tuck Taffeta Ribbon Adhesive Tape No. 601. The tape is made of celanese acetate rayon and is available in a wide range of colors. It is available in both counter display rolls and in large rolls for use in dispensers at gift counters.

Johnson Tower Under Construction

The new research and development tower of S. C. Johnson and Son, Inc., described as being one of the most fascinating commercial buildings of this age, is under construction in Racine, Wisconsin. It is the creation of Frank Lloyd Wright, famed architect, who designed the wax company's ultra-modern administration building which has attracted wide attention since its completion ten years ago. The new tower will reach 156 feet into the air, have 15 floors devoted to research, and will house some 75 technologists. With an inner core of concrete and cantilevered floor levels contained in double walls of glass, it will have the appearance of a giant circular stairway, encased in gleaming glass.

Insulation Alignment Chart

Insulation prevents cold-surface sweating on piping, ducts, tanks and other vessels containing cold air or low temperature fluids—providing the thickness of the insulation is sufficient. Guesswork and the use of formulas to determine proper thickness of insulation is eliminated by a new alignment chart developed by the Industrial Mineral Wool Institute. The minimum insulation thickness which prevents surface condensation is easily determined by the use of the chart, copies of which may be obtained without cost from the Institute at 441 Lexington Ave., New York 17, N. Y.

NEWS IN BRIEF

The New York office of the J. O. Ross Engineering Co., for many years located at 350 Madison Avenue, has been moved to new and larger quarters at 444 Madison Avenue.

The appointment of A. C. Nispel, Inc., of Boston, Mass., as sales agent for most of the New England territory, has been announced by the Ferro Chemical Corp. Complete warehouse stocks will be carried in Boston.

A brochure covering prices and analyses of its reclaims has been issued by the Midwest Rubber Reclaiming Co. Grades covered include whole tire, peel, carcass, inner tube, fiber bearing, and tailings.

A new type of stacking and nesting tote box formed in one seamless piece from its Royalite thermoplastic material has been announced by U. S. Rubber. Handles are formed into the roll of the upper lip so that the tote box can be picked up from any side. The boxes are being made in a wide range of widths and depths at the company's Chicago plant.

A technical bulletin covering the use of Indonex plasticizers in Neoprene W compounds has been issued by the Indoil Chemical Co. Ask for Circular No. 13-41.

Production of its 500,000,000th pneumatic motor vehicle tire was recently reached by Goodyear at Akron. The half-billionth tire was a 7.60 x 15 passenger car size. It is estimated that the 500,000,000 tires produced by the company, lined up tread to tread, would reach around the earth at the equator more than nine times.

As of June 30, E. I. du Pont de Nemours & Co., Inc., was owned by 118,732 stockholders, an increase of 2,861 over the number of holders recorded at the close of the first quarter of the current year and an increase of 19,069 over the number as of June 30, 1949.

A new complete line of fire hose couplings and accessories was recently brought out by the Hose Accessories Co., Philadelphia 32, Penna. The new line is described in Bulletin No. 7 which also contains thread data on all standard U. S. hose coupling threads.

Automobile travelers' suits or dresses stay wrinkle-free in a lightweight bag designed to hang in a car. Produced by Princess House, New York, the bag is made of Vinylite, and is available in a choice of colors.

Ohio Rubber is building a new $120,000 warehouse at Willoughby, Ohio. The structure's 30,000 square feet of storage space will make it one of the largest warehouses in Lake County.

General Electric rubber-phenolic wood-flour-filled compound is being used to make the plastics base on Air Flight circulators manufactured by the W. W. Welch Co. of Cincinnati. Since these air circulators rest on the floor, they are subject to various shocks. The bases were molded by the Cambridge Molded Plastics Co. of Cambridge, Ohio.

A new wholesale price list has been issued by Fritzsche Brothers, Inc., New York. Distribution of the list is limited to those who buy in wholesale quantities only, but copies are available to such purchasers on letterhead request.

Simplex Wire & Cable Co. has announced the removal of its New York office to 100 Park Ave. The phone number is LExington 2-1157.

A new brochure emphasizing the necessity for various technical services has been issued by Sam Tour & Co., Inc., New York. Entitled "All Under One Roof," the brochure portrays the work of the company's scientists, engineers, consultants and laboratories, and explains the scope of the services available.

Northeastern Plastics, Inc., Boston, has introduced a new office aid for sealing envelopes, moistening labels and similar work. Consisting of a flexible Bakelite polyethylene tube and a sponge roller partially enclosed in a housing, a slight squeeze on the tube starts water flowing into the roller, the water continuing to flow at an even rate as the sealer is moved across adhesive surfaces.

Reprints of an article on "Assembly of Thin-Walled Parts by Rubber Crimping" by Frank R. Simpson are currently available from the Franklin Institute, Philadelphia 3, Penna. The article originally appeared in the March, 1950, issue of *Product Engineering*.

A warehouse for Koroseal upholstery material has been established by Goodrich at High Point, N. C. It is reported to be the first of many similar units planned by the company around the country.

A technical bulletin on Pliolite S-6B, a new rubber reinforcing resin for improving the processing of shoe sole stocks, has been made available by Goodyear's Chemical Division. The bulletin describes properties and explains compounding procedures, processing and applications. Ask for Techni-Guide 601-B.

A new, small-size hair curler made of Vinylite is being produced by Tip-Top Products Co., Cuming at 16th St., Omaha, Nebraska.

Permaproof 300, a new flameproofing compound for application to all types of cloth, is now being offered commercially by the Treesdale Laboratories, Inc., Pittsburgh. The compound differs from many conventional flameproofing materials in that it contains no pigment, but is a liquid dispersion based on a Geon latex.

A technical bulletin on "Compounding of Neoprene with Fine-Particle Silica" has been made available by Columbia Chemical. It is a reprint of the article which appeared in the June, 1950, issue of RUBBER AGE. Ask for Pigment Data Bulletin No. 50-7.

In conjunction with its new highway safety education program a booklet entitled "Crazy Drivers" is being distributed by the Inter-Industry Highway Safety Committee, Washington 6, D. C. Sketches in the booklet depict twelve of the many careless and dangerous driving habits motorists perform daily.

A new disposal bag made of Vinylite is a feature of a new tray being made by Trimble, Inc., Rochester 13, N. Y., for attaching to a baby bath. The bag for baby's soiled clothing is resistant to moisture and most chemicals and lifts out of the tray for carrying to the laundry.

A compact, easy to use safety eyewear selector has been made available by Bausch & Lomb, Rochester, N. Y., to aid industrial safety directors in choosing the proper safety glasses for 69 specific jobs. Copies are available on request to any branch office.

A brief description of the manufacture of latex foam sponge rubber is contained in the June, 1950, issued of the *Horse Head Bulletin*, popular house organ of the N. J. Zinc Co. Some new developments in parking meters are covered in the same issue.

Weiss & Klau Co., of New York, is producing a tablecloth of Vinylite film colorfully printed with the appearance of fine block linen. It is quickly and easily cleaned with a sponge or damp cloth and does not require ironing.

To meet the increasing demand for tires in Mexico, U. S. Rubber recently flew 12,000 pounds of rayon cord fabric from its Havana branch to its subsidiary at Mexico City. Shipment was made via Pan American World Airways Cargo Clipper.

A reference guide to its various silicone products has been made available by the Dow Corning Corp., Midland, Mich. The guide covers silicone fluids, compounds, greases, resins and varnishes, rubber and miscellaneous chemicals. Copies are available from the company on request.

Dow Chemical is planning the construction of a multi-million dollar plant near New London, Conn., for the production of polystyrene. Present plans are said to call for the plant to be built on a 78-acre site about 10 miles north of New London.

Rubber BLACKS

ESPECIALLY ENGINEERED FOR SPECIFIC COMPOUNDING NEEDS

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For Better Service

The engineering of carbon blacks for optimum performance in the various categories of rubber compounding is a constant challenge to our research staff. Maintaining the quality and uniformity of these blacks demands alert and precise production controls. To perform these functions better, for effective service to the rubber industry, is the goal toward which our technical effort always is directed.

COLUMBIAN CARBON CO. MANUFACTURER

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NEW POLYMERS AUTHORIZED BY OFFICE OF RUBBER RESERVE, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Rubber Reserve, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Sales Division of Rubber Reserve or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X Number	*Manufacturing Plant*	*Date of Authorization*	*Polymer Description*
X-585 GR-S	Copolymer, Baton Rouge	6-9-50	Butadiene/styrene charge ratio 80/20, adjusted to give 16 ± 1 per cent bound styrene on the finished polymer, activated with cumene hydroperoxide or diisopropylbenzene monohydroperoxide or mixture of both, polymerized at 41° F. Emulsified with Dresinate 214; shortstopped with DNCB. Mooney viscosity 46 ± 7. Stabilized with 1.25% PBNA.
X-586 GR-S	U. S. Rubber, Borger	6-14-50	A mixture of 50 parts uncompressed Philblack O and 100 parts of polybutadiene, Marasperse and NaOH used in carbon black slurry make-up. Charge formulation: 100 parts butadiene activated with cumene hydroperoxide, polymerized at 86° F. Emulsified with Dresinate 214. Shortstopped with DNCB. Mooney viscosity 25. Stabilized with 1.5% BLE.
X-587 GR-S	U. S. Rubber, Borger	6-14-50	Butadiene/styrene charge ratio 81.5/18.5, adjusted to give 15 ± 1% bound styrene on the finished polymer; activated with cumene hydroperoxide, polymerized at 41° F. Emulsified with Dresinate 214; shortstopped with hydroquinone. Mooney viscosity 50. Stabilized with 1.25% BLE.
X-588 GR-S	General, Baytown	6-21-50	A mixture of 50 ± 2 parts Philblack O and 100 parts of a GR-S polymerized at 41° F. Sodium lignin sulfonate, Dresinate 214 and lignin used in carbon black slurry make-up. Butadiene/styrene charge ratio 75/25, adjusted to give 20 ± 1% bound styrene on the finished polymer, activated with cumene hydroperoxide and/or diisopropylbenzene hydroperoxide. Emulsified with Dresinate 214 and K-ORR soap; shortstopped with DNCB. Shortstop Mooney viscosity, ML-4, at 212° F., 36 ± 5. Stabilized with 1.5% PBNA.
X-589 GR-S	General, Baytown	6-21-50	A mixture containing 50 ± 2 parts Philblack O and 100 parts GR-S type polymer. Butadiene/styrene charge ratio 75/25, adjusted to give 20 ± 1% bound styrene on the finished unpigmented polymer. Shortstop Mooney viscosity 45 ± 5 (ML-1.5 min. @ 212° F.). Stabilized with 1.5% PBNA.
X-590 GR-S	Copolymer, Baton Rouge	7-5-50	Butadiene/styrene charge ratio 71/29, activated with cumene hydroperoxide or diisopropylbenzene hydroperoxide or Diox 7 or a mixture of these; polymerized at 41° F. Emulsified with Dresinate 214; shortstopped with DNCB. Mooney viscosity 52. Stabilized with 1.25% PBNA.
X-591 GR-S	Copolymer, Baton Rouge	7-5-50	Butadiene/styrene charge ratio 80/20, adjusted to give 16 ± 1% bound styrene on finished polymer, activated with cumene hydroperoxide or diisopropylbenzene hydroperoxide or Diox 7 or a mixture of these; polymerized at 41° F. Emulsified with Dresinate 214; shortstopped with DNCB. Mooney viscosity 46. Stabilized with 1.25% PBNA.
X-592 GR-S	U. S. Rubber, Naugatuck	6-28-50	Butadiene/styrene charge ratio 71.5/28.5, activated with cumene hydroperoxide, polymerized at 41° F. Emulsified with Dresinate 731; shortstopped with sodium dimethyl dithiocarbamate. Mooney viscosity 90. Stabilized with 1.25% BLE.
X-593 GR-S	Firestone, Lake Charles	7-24-50	Butadiene/styrene charge ratio 71/29, activated with diisopropylbenzene monohydroperoxide, polymerized at 41° F. Emulsified with Dresinate 214; shortstopped with DNCB. Mooney viscosity 55 ± 7. Stabilized with 1.25% PBNA.
X-594 GR-S	General, Baytown	7-10-50	A mixture of 50 ± 2 parts Philblack O and 100 parts GR-S type polymer, polymerized at 41° F. Sodium lignin sulfonate, Dresinate 214, and lignin used in carbon black slurry makeup. Butadiene/styrene charge ratio 85/15, activated with cumene hydroperoxide or diisopropylbenzene hydroperoxide or mixture of both. Emulsified with Dresinate 214 and K-ORR soap; shortstopped with DNCB. Shortstop Mooney viscosity 36 ± 5 ML-4 at 212° F. Stabilized with 1.5% PBNA.

NOTE: The above new polymers are experimental only and the Office of Rubber Reserve, Reconstruction Finance Corporation, does not make any representations or warranties of any kind, expressed or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

NAMES IN THE NEWS

JOHN T. BLAKE, director of research for the Simplex Wire & Cable Co., Cambridge, Mass., was recently elected chairman of the Northeastern Section of the American Chemical Society.

FRED J. BOWMAN, formerly vice-president of the Wilson Sporting Goods Co., Chicago, Ill., has been elected president of the company, succeeding the late L. B. ICELY.

DRS. E. W. VOLKMANN and F. L. JONES have been named assistant managers of the Research Department of Koppers Co., Inc., Pittsburgh, Penna.

THOMAS J. KERR, formerly associated with the Pantasote Leather Co., is now operating as a consulting technologist, with headquarters in Collins, N. Y. He is specializing in the development and manufacture of plastic film and sheeting and coated fabrics.

THOMAS H. FITZGERALD, associated with U. S. Rubber for the past 27 years, has been named sales manager of reclaimed rubber for the Naugatuck Chemical Division of the company.

J. G. TAYLOR, associated with the General Tire & Rubber Co. for the past 12 years, most recently as Akron district sales manager, has been named director of government operations for the company with headquarters in Washington, D. C.

WILLIAM M. SHINE, formerly associated with the Central Sales Development Department of General Aniline & Film Corp., has joined the Plastics Department of Arnold, Hoffman & Co., Inc., New York, N. Y.

ROBERT K. MULTER, a recent graduate of the University of Cornell with a B.S. degree in chemical engineering, has joined the staff of the Marbon Corp., Gary, Ind., as a development engineer.

LEWIS L. STRAUSS, New York banker and former member of the Atomic Energy Commission, has been named to the board of the General Tire & Rubber Co., Akron, Ohio.

CLARENCE O. PERKINS, back in the United States awaiting reassignment after 5 years as commercial manager of the General Tire & Rubber Co.'s affiliated plant in Santiago, Chile, has been appointed a member of the Order of Merit by the president of Chile in recognition of his services in the promotion of U. S.-Chilean friendship.

EDWARD W. RHEINS, formerly sales promotion manager of the Bigelow-Sanford Carpet Co., has joined the Dayton Rubber Co. as merchandising manager for Koolfoam products.

Named Tire Division Executive

John M. Miller

John M. Miller, formerly factory manager of the Los Angeles, Calif., plant of the U. S. Rubber Co., has been named an assistant general manager of the Tire Division with headquarters at the company's offices in New York. Mr. Miller joined U. S. Rubber in 1940 in charge of the Providence, R. I., factory. Born in Clinton, Ill., Mr. Miller was graduated from Notre Dame University in 1917. During World War II he managed the Scioto Ordnance Plant at Marion, Ohio, for U. S. Rubber, and subsequently spent seven years on the West Coast as factory manager. Richard B. Behrman, who held the position of Industrial Relations Manager at the Los Angeles plant, has been named factory manager to succeed Mr. Miller. At the same time it was announced that Lester B. Reeves, assistant director of manufacturer's sales, was given the new assignment of Government sales with headquarters in Detroit, Mich. Mr. Reeves, a graduate of the University of Texas, joined the company in 1941. Thomas J. Newton, formerly manager of the Tire Engineering Replacement Section, has been appointed general service manager of the Tire Division. Mr. Newton is a graduate of the University of Detroit, and served in the War Department as assistant rubber director in 1944 and 1945. He has been employed by U. S. Rubber in Test Wheel and Field Service Engineering for the past 15 years.

F. B. HAVENS, formerly technical field service representative for the Pigment Department of the Calco Chemical Division of the American Cyanamid Co., has been appointed Pacific Coast regional manager of the Pigments Department with headquarters in San Francisco.

P. B. BALDWIN, previously director of sales for the Collins & Aikman Corp., has been elected vice-president of the company in charge of sales and merchandising.

Goodrich Appointments Announced

Howard J. Korsmo, associated with the B. F. Goodrich Co. for the past 13 years, has been named production superintendent of tire manufacturing in Akron. At the same time, it was announced that Delbert L. Crone, associated with the company since 1927, has been named production manager of inner tube and solid tire manufacturing also in Akron. Mr. Korsmo began his career as an industrial engineer in tires. He became production superintendent of the company's Oaks, Penna., plant in 1945 and held that post until 1949, when he was given a special assignment as factory manager of the Holland plant. Mr. Korsmo returned to Akron last June. Mr. Crone became a general foreman in the Akron plant in 1929, and later was transferred to Kitchener, Ont., where he remained until October, 1945, when he returned to the Akron plant. Both men will be under the supervision of P. W. Perdriau, superintendent of the Akron Tire Manufacturing Division.

U. S. Rubber Wins Safety Award

The U. S. Rubber Co. proving grounds at Lancaster, Calif., observed the occasion of 1,400,000 miles of accident free driving by its test fleet in a Safety Celebration on July 29. To acknowledge the event, a safety award was made to Richard Beresford, manager of the installation, by Ernest W. Beck, director of safety for the company. In the experimental station at Lancaster, U. S. Rubber operates a fleet of cars and trucks to test its tires and tubes under all conditions of driving. Statistical records are forwarded to the Central Tire Development Laboratories of the company at Detroit, Mich., for evaluation and use in setting specifications for the building of safer casings and tubes.

Wyandotte Buys Western Plant

Wyandotte Chemicals Corp., Wyandotte, Mich., has purchased the Pacific Chemical plant of the American-Marietta Co. of Los Angeles, Calif. The purchase price was not disclosed. Wyandotte will revamp the property to provide a Pacific Coast manufacturing unit to serve company branches which have functioned for a number of years in coastal cities. Pacific Chemical's plant and sales personnel will be absorbed by Wyandotte's Pacific Division, and the Wyandotte research and technical service staffs, numbering nearly 200 persons, will become available to users of Pacific Chemical products as well as to companies using Wyandotte products.

Food is said to keep longer and fresher in refrigerators and freezers with a new strap-type closure and bag of Bakelite polyethylene currently being marketed by Shore Line Industries, Inc., of Clinton, Conn. The new closure strap, especially designed for freezer use to facilitate easy opening and closing of packages, fastens by merely slipping one end through a slit in the opposite end, completely sealing the bag and its contents.

Producing Myrcene From Beta-Pinene

The Southern Regional Research Laboratory of the U. S. Department of Agriculture, New Orleans, La., has developed a process for producing myrcene, a useful chemical intermediate, from beta-pinene, a component of gum turpentine.

Myrcene is a polyolefin with three double bonds, two of which are in terminal conjugation. It can be substituted for butadiene or isoprene in the manufacture of chemical rubber, reacted with maleic anhydride or other dibasic acids to form resins, or it can be hydrated to produce polyhydric alcohols suitable for use in perfume bases. Other uses are well known in the chemical industry.

The new method of isomerizing beta-pinene to myrcene is based on the discovery that much higher yields and a better quality product can be obtained at temperatures considerably above those already used, provided the vapor is subjected to such temperatures very briefly. High quality myrcene representing as much as 85 percent of the beta-pinene used has been produced by subjecting vapors of beta-pinene to a temperature above 700° C. for less than one-hundredth up to about a tenth of a second. The procedure is suitable for use in a small reaction system.

Other information including details on patent rights may be obtained from the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, Washington 25, D. C.

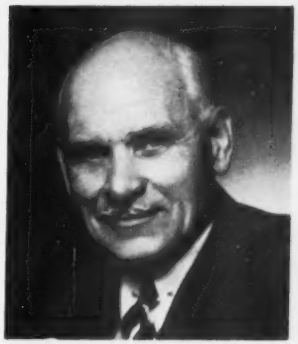
ISO to Hold 1952 Meeting in U. S.

The American Standards Association, 70 East 45th St., New York 17, N. Y., has announced that the International Organization for Standardization has accepted an invitation to hold its 1952 General Assembly in the United States. As the United States member, the ASA presents the viewpoint of U. S. groups on standards that come before the ISO for international consideration. More than 100 national technical societies and associations and some 1,700 leading industrial firms are ASA members. Seventy-one international technical committees are working to bring about agreements on definitions, terminology, specifications dimensions, and test methods in the national standards of the member countries. The U. S. is taking an active interest in many fields including rubber, plastics, tires, rims and valves.

Titanium Pigments Facilities

National Lead Co., New York 6, N. Y., has begun the construction of new facilities for the production of titanium pigments. The additional capacity is expected to increase the present rate by 60,000 to 70,000 tons annually, and will be added first at the company's St. Louis plant. First production from the new facilities should be realized within a year and full production within eighteen months. The new expansion follows closely upon post-war titanium pigment plant expansion by the company and is in step with a reported substantial increase in the use of titanium pigments.

Named Naugatuck Production Head



John C. H. Wendes

John C. H. Wendes, associated with the U. S. Rubber Co. for the past 22 years, has been named production manager of the Naugatuck Chemical Division of the company with headquarters in Naugatuck, Conn. Mr. Wendes will supervise all manufacturing and engineering operations in the synthetic rubber plants operated by the division in Naugatuck, Port Neches, Tex., and Borger, Tex. He will also supervise manufacturing and engineering activities in the Marvinol vinyl resin plant at Painesville, Ohio, and the Naugatuck Chemical plant at Naugatuck. At the same time the appointment of Joseph P. Monahan as general control manager of the Naugatuck Chemical Division was announced. Mr. Monahan will be in executive charge of accounting and accounting control in all four plants of the division.

Stokolite L-44 Rubber Dipper

Stokes Molded Products, Inc., Trenton 4, N. J., has developed the Stokolite L-44 dipper which is said to provide a greatly increased safety factor in the handling of corrosive liquids. Made of Stokolite L-44 compound, which has a base of virgin rubber, the new dipper is streamlined for lightness and has an efficient pouring lip and a well reinforced handle. The nature of the material gives it unusually high resistance to shock, abrasion, heat, and chemical corrosion. The dipper, made in one-quart and two-quart sizes, comes as a companion to the Stokolite pail which the company put on the market last fall.

New Goodrich Off-the-Road Tire

A new off-the-road tire in its Universal line, especially designed for front wheels where easier steering is desired, has been announced by the B. F. Goodrich Co., Akron, Ohio. The ribbed tread on the tire has been especially engineered for this purpose, and construction of the tire is the same as the conventional Universal. The tire is available in three popular sizes, 12.00-24, 16 ply rating; 13.00-24, 18 ply rating; and 14.00-24, 20 ply rating.

J. P. Stevens Personnel Changes

Robert E. Henry, vice-president of J. P. Stevens & Co., Inc., New York 13, N. Y., and William Fraser, secretary, have retired from the firm. Both will continue as directors. Kenneth W. Fraser has been appointed to the newly-created post of financial vice-president. In that capacity, he will become the company's senior financial officer. A. J. Smith has been appointed treasurer of the company. His duties include supervision of the company's Credit Department. T. B. Jackson has been named assistant secretary. William Fraser, a past president of the New York Credit Men's Association and the National Association of Credit Men, has been with the firm since the founding of the original partnership in 1899 and was treasurer of the present company since its incorporation in 1923.

Mr. Henry has been associated with the firm and its predecessors since 1919. He was president of the American Cotton Manufacturers Association prior to its merger with the Cotton Textile Institute and is a director of the American Cotton Manufacturers Institute. Kenneth W. Fraser joined Stevens in 1937, has served as comptroller since 1946 and was elected director in 1930. Mr. Smith joined the company in 1930 and had been assistant treasurer and member of the finance committee since 1946. Mr. Jackson has been employed by Industrial Cotton Mills, now a division of Stevens, since 1921.

Nebony Thermoplastic Resin

The Neville Co., Pittsburgh 25, Penna., recently introduced Nebony, described as a new, low cost, very mild odored, non-reactive, dark, neutral thermoplastic resin derived from petroleum. The new material, which finds special application in mastic and rubber floor tile, rubber compounding, automobile undercoatings, phonograph records, etc., has several melting points ranging up to 120° C. cube-in-mercury method. It is soluble in aromatic and chlorinated solvents, ketones and esters, and insoluble in water, alcohols and glycols. It is compatible with alkyd, phenolic, coumarone, styrene and natural resins, as well as with rosin, rubber and chlorinated rubber. It is also compatible in certain proportions with ethyl cellulose, polyvinyl acetate and polyvinyl copolymers. Nebony is reported to have excellent reagent resistance.

Publish 1949 ASTM Proceedings

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna., has announced publication of its "Proceedings" for 1949. The "Proceedings" are published annually and include all reports and papers offered to the Society during a calendar year which are accepted by the Administrative Committee on Papers and Publications. The report of Committee D-11 on Rubber and Rubber-Like Materials, presented at the 52nd Annual Meeting of the Society, held on June 27-July 1, 1949, is included in the current "Proceedings."

FINANCIAL NEWS

B. F. Goodrich Company

First Half: Consolidated net income of $12,427,793, which is equal to $8.76 a common share after providing reserves of $2,000,000 for increased replacement cost of facilities and $1,000,000 for possible inventory price declines. Net income for the first half of 1949 totaled $8,909,635, or $6.02 a share after providing for raw material inventory from cost to market and a reserve of $2,000,000 for increased replacement cost of facilities. Net sales in the first half of 1950 amounted to $231,612,854, compared with $192,149,550 for the first six months of the preceding year. Inventories on June 30, 1950, were $89,872,822 compared with $98,777,781 on June 30, 1949. Net working capital increased to $162,623,669, from the $154,655,555 the year before. The consolidated balance sheet as of June 30, 1950, shows current assets of $195,030,847 and current liabilities of $32,407,178, a ratio of 6 to 1.

Minnesota Mining & Mfg. Co.

First Half: Net income of $9,682,389, which is equal to $4.80 a common share, compared with $6,330,227, or $3.11 a share, for the first six months of 1949. Net sales in the first half of 1950 totaled $65,577,460, against $54,552,850 in the first six months of the preceding year.

Raybestos-Manhattan, Inc.

First Half: Net profit of $1,545,952, which is equal to $2.46 a share, contrasted with $830,849, or $1.32 a share, for the first six months of the preceding year. The figures include the domestic subsidiaries of the company.

Union Asbestos & Rubber Co.

First Half: Net profit of $135,996, which is equal to 29c a share on net sales of $3,735,704, compared with $594,017, or $1.20 a share on net sales of $5,387,034 in the first six months of 1949.

Baldwin Rubber Co.

Year Ended June 30: Net profit of $1,445,941, which is equal to $3.67 a share, compared with $854,100, or $2.17 a share, in the preceding fiscal year.

Pantasote Company

First Half: Net profit of $2,821 on sales of $2,694,728, contrasted with a loss of $69,606 on sales of $2,087,097 in the first six months of 1949.

Brown Rubber Co.

First Half: Net profit of $594,085, which is equal to $1.58 a common share, compared with $700,657, or $2.79 a share, in the first six months of 1949.

Goodyear Tire & Rubber Co.

First Half: Net profit of $11,914,465, which is equal to $5.08 each on 2,065,411 shares of capital stock, against $8,133,358, or $3.24 each on an equal number of shares, in the first half of 1949. Net sales for the period ended June 30, 1950, totaled $344,887,654, contrasted with net sales of $311,823,235 in the first half of the preceding year. The semi-annual report showed that Goodyear had reduced its funded debt from $100,000,000 to $95,001,000 through the prepayment of $4,999,000 of nearby maturities without premium on June 15. The report states that capacity operations are continuing in all plants; that working capital has reached a new high of $266,200,000, and that inventories, despite expanded volume, are slightly less than a year ago, being carried at $164,241,713 on June 30, 1950, against $165,056,341 on June 30, 1949.

Columbian Carbon Co.

First Half: Net income of $2,930,524, which is equal to $1.82 a share, compared with $3,618,092, or $2.24 a share in the first half of 1949. Earnings for the 1949 period included $1,429,608 realized from the sale of investment in the Mississippi River Fuel Corp. The share earnings on this extraordinary income were equal to 88c a share. Earnings for the 1950 period result entirely from ordinary operations and do not include any such extraordinary non-recurring profit.

Seiberling Rubber Co.

First Half: Net profit of $581,998, which is equal to $1.53 each on 301,010 common shares, compared with a net loss of $247,525, in the first half of 1949, after giving effect to a $142,256 tax credit. Sales in the first half of 1950 totaled $15,130,847, against net sales of $11,969,830 for the six months ended June 30, 1949.

Thermoid Company

First Half: Net income of $704,296, which is equal to 85c a common share, compared with $419,578, or 47c a share, in the first half of 1949. Sales for the first half of 1950 amounted to $12,303,386, contrasted with $11,219,468 in the first half of the preceding year.

DeVilbiss Company

First Half: Net income of $188,969, which is equal to 63c a share, compared with $114,905, or 38c a share, in the first half of 1949.

Anaconda Wire & Cable Co.

First Half: Net profit of $1,927,049, which is equal to $2.28 a common share, compared with $1,722,383, or $2.04 a share, for the first half of the preceding year.

New Jersey Zinc Co.

First Half: Net profit of $2,312,719, which is equal to $1.18 a share, contrasted with $3,223,638, or $1.65 a share, for the corresponding period of 1949. The 1950 figure excludes net extraordinary income of $195,269 which was transferred to reserve for contingencies. The 1949 figure reflects a provision of $500,000 for contingencies.

Electric Auto-Lite Co.

First Half: Net income of $5,187,591, which is equal to $3.47 a share, compared with $3,593,707, or $2.40 a share in the first half of 1949. Net sales for the 1950 period amounted to $94,423,558, against $106,949,904 for the six months ended June 30, 1949.

Garlock Packing Co.

First Half: Net income of $668,194, which is equal to $1.59 a common share, compared with $367,165, or 87c a share, in the first six months of 1949. Sales for the first half of 1950 were 8% higher than the first half of the preceding year, and 22% higher than in the last half of 1949.

Mansfield Tire & Rubber Co.

First Half: Net income of $703,889, which is equal to $4.31 a common share, compared with $35,592, or 13c a share, in the first half of 1949. Gross sales in the first six months of 1950 increased to $20,490,413 from $11,897,843 a year earlier.

Cooper Tire & Rubber Co.

First Half: Net profit of $122,472, which is equal to 78c a common share on net sales of $5,139,909, compared with a loss of $93,053, after a tax credit of $57,033, on net sales of $2,891,172 for the first half of 1949.

United Carbon Co.

First Half: Net profit of $1,639,766, which is equal to $2.06 each on 795,770 shares of capital stock, compared with $1,353,303, or $1.70 each on an equal number of shares in the first half of 1949.

O'Sullivan Rubber Corp.

First Half: Net income of $59,479, which is equal to 11c a common share on net sales of $2,400,531, compared with a deficit of $31,777 on sales of $1,692,254 last year.

Intercontinental Rubber Co.

First Half: Net loss of $130,053, compared with a loss of $277,468 in the first half of the preceding year. The figures cover the operations of the company and its subsidiaries.

Form Hale & Kullgren, Inc.

Andrew Hale and G. V. Kullgren, both formerly associated with the Adamson United Co. and both widely known in the rubber and plastics machinery fields, have pooled their talents and have organized the firm of Hale & Kullgren, Inc., with offices at 326 South Main St., Akron 8, Ohio. The new concern will specialize in the design, development and sale of machinery to the rubber and plastics field, and intends to engage in more-or-less revolutionary types of equipment rather than in the handling of existing types of equipment, such as mills, calenders, etc.

Hale and Kullgren, Inc., is affiliated with the Aetna-Standard Engineering Co., of Youngstown, Ohio, one of the leading producers of production equipment for the steel and non-ferrous metal working industries, and will act as the sole representatives of that company in the design, development and distribution of processing equipment for the rubber and plastics industries. Aetna-Standard cooperated in the formation of Hale and Kullgren, Inc. Ernest E. Swartswelter is president of Aetna-Standard.

Mr. Hale first entered the rubber machinery fields as manager of the Akron office of Farrel-Birmingham, Inc., in 1923. He remained with that company until January, 1945, when he resigned to become vice-president in charge of sales and engineering for the Adamson United Co. shortly after it was organized by the United Engineering & Foundry Co. upon acquisition by that company of the former Adamson Machine Co. During World War II, Mr. Hale was associated with the Office of the Rubber Director at Washington as a counsel on mill room equipment.

Mr. Kullgren was employed by the General Electric Co. in the 1933-43 period, during the latter part of which he was engaged in application engineering for the rubber and paper industries. He joined Farrel-Birmingham, Inc., in 1943 as assistant manager of the Akron office, leaving that post in February, 1945, to join the Adamson United Co. in charge of all contract engineering. Mr. Kullgren is particularly noted for his work in the design of calenders and accessory process equipment.

Industrial Truck Safety Standards

Safe practices in the design and use of industrial power trucks have been established by nationwide agreement among users, safety engineers, and manufacturers, the American Standards Association reported recently. The recommendations, representing a consensus of all who are substantially concerned, have been published as a safety code. The standard applies to industrial trucks of both the driver-ride and driver-lead types, such as platform trucks, tractors, low-lift trucks, fork trucks and special purpose trucks. It does not apply to motor vehicles intended for operation on the highways. Copies of American Standard B56.1-1950 are available from either the American Standards Association, 70 East 45th St., New York 17, N. Y., or the American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y., at 85c each.

View of Firestone Memorial

In connection with the celebration of the 50th anniversary of the Firestone Tire & Rubber Co., held in Akron last month as reported in our previous issue, the five sons of Harvey S. Firestone unveiled a statue of their father. Located on 25 acres of trees and lawn surrounding the Firestone Research Building, the statue, which is the focal point of an impressive memorial, overlooks the mile-long array of plants which are the nucleus of the world-wide industrial organization Mr. Firestone founded in 1900. Left to right, the five sons, all active in the management of the company, are: Roger S. Firestone, president of the Firestone Plastics Co.; Raymond C. Firestone, vice-president of the Firestone Tire & Rubber Co.; Russell A. Firestone, a director of the parent company; Leonard K. Firestone, president of the Firestone Tire & Rubber Co. of California, and Harvey S. Firestone, Jr., chairman of the parent company.

Goodyear Announces Promotions

Merle E. Wendt, formerly in charge of vinyl production development service and technical sales service on adhesives and latices for the Goodyear Tire & Rubber Co., Akron, Ohio, has been elevated to assistant manager of the Chemical Products Development Division. In his new capacity, Mr. Wendt will report to M. J. DeFrance, division manager. Kermith K. Fligor, associated with the Chemical Development Laboratory of the company, has moved into the position vacated by Mr. Wendt. Mr. Wendt joined Goodyear following his graduation from Ohio State University in 1938. He spent his entire time with the company in chemical development and production work. Mr. Fligor, a native of Brewster, Ohio, holds a degree in chemical engineering from Ohio State University. He joined the Chemical Development Laboratory staff in 1949 after some 15 years of active experience in the chemical and plastics field.

A technical chart to assist engineers and operating personnel in quickly checking power requirements for liquid agitation of most types is offered by Process Industries Engineers, Inc., 5941 Baum Blvd., Pittsburgh 6, Penna.

Naugatuck Chemical Promotes Opper

Richard K. Opper, formerly technical sales representative for the Naugatuck Chemical Division of the U. S. Rubber Co. in the Chicago, Ill., area, has been named assistant sales manager of rubber chemicals for the division. Mr. Opper joined U. S. Rubber in 1929 as a chemist in the company's general laboratories at Passaic, N. J. With a solid background in rubber technology, he entered sales work for Naugatuck Chemical in 1946. In his new position, he will make his headquarters at the division's plant in Naugatuck, Conn. Howard G. Ling, formerly technical representative in New York, will replace Mr. Opper in the Chicago district. Mr. Ling has been active in rubber technology since 1928. Until recently he was vice-chairman of the New York Rubber Group. David E. Welch has been named technical representative in the New York area, replacing Mr. Ling. He will make his headquarters in Lumberville, Pa. Mr. Welch was with the B. F. Goodrich Co. and the Office of Rubber Reserve in Washington prior to joining Naugatuck Chemical.

Fisk Safti-Flight Tire Offered

A new custom-quality tire for passenger cars has been announced by the Fisk Tire Division of the U. S. Rubber Co. Called the Fisk Safti-Flight, the new tire is built specifically to prevent blow-outs and skidding. In appearance, the tire has new distinctive features. The terraced sidewalls represent what is said to be a complete departure from tire designs of the past. The tread design includes multiple safety slotting for quicker stopping and sure-footed control at highway speeds. The safety slots are spaced to eliminate pitch noises while the new groove shape keeps stones out of the tread. A defender scuff guard is another new feature of the Safti-Flight. The scuff guard blocks every blow of curb or rut. The multiple safety slotting provides more than 3,000 safety slots across the tread face and 64 sharp rib edges around the tread face. The tread features a compact footprint which means more rubber on the road. The tire casing is of the low-pressure variety.

General Aniline Purchase Sought

Officials of Remington Rand, Inc., disclosed recently that discussions were continuing on the possible settlement of a suit in which the firm seeks to acquire control of the General Aniline & Film Corp. Approximately 97% of the stock of General Aniline is owned by a Swiss firm, Interhandel, A. S., and was seized by the Federal Government during the war on the grounds that it actually was owned by the I. G. Farben combine of Germany. The Swiss owners denied there was German ownership and sued for recovery of the stock. Remington Rand intervened as an interested party, contending it held an option to buy from the Swiss owners for $25,000,000. A Federal District Court in Washington, D. C., ruled against Remington Rand and the company has appealed from the ruling. The hearing is set for September.

ADDITIONAL TECHNICAL PUBLICATIONS OF BRPRA MADE AVAILABLE

Abstracts of some of the recent publications issued by the British Rubber Producers' Research Association are published from time-to-time in RUBBER AGE. These Booklets, which cover research work conducted by various members of the BRPRA staff, may be secured by writing the Association at 19 Fenchurch Street, London, E. C. 3, England. Abstracts of some of the more recent publications follow:

Large Elastic Deformations of Isotropic Materials. Part III. Some Simple Problems in Cylindrical Polar Co-ordinates, by R. S. Rivlin. (Publication No. 94): The theory developed in Part I is applied to the solution of the problem of the simple torsion of a cylinder and of a tube of highly-elastic material. It is found that it is necessary to apply, in addition to a torsional couple, longitudinal thrusts. If the latter are not applied, then the cylinder elongates. For a tube, an inflating pressure must also be applied.

The Dielectric Relaxation of Mixtures of Dipolar Liquids, by Adolph Schallamach. (Publication No. 95): The dielectric constants of a number of binary mixtures of polar liquids were determined and the following results were obtained. Binary mixtures containing only non-associated, or only associated, liquids have normal loss-factor vs. temperature curves with one well defined maximum. But the dielectric characteristics of mixtures of a non-associated and an associated liquid are not normal, and they show two maxima of the loss-factor curve when the relative concentrations are such that the contributions of each component to the dielectric loss are comparable. Assuming that one maximum of the loss-factor curve means one relaxation mechanism, it was deduced from these findings (1) that dielectric relaxation involves a volume containing certainly more than one molecule, and (2) that mixtures of a non-associated and an associated liquid are inhomogeneous on the microscopic scale.

The Reaction of Sulphur and Sulphur Compounds with Olefinic Substances. Parts I, II, III, and IV. (Publication No. 96): Part I. The Reaction of Sulphur with Mono-olefins and with Δ 1:5 Diolefins, by E. Harold Farmer and F. W. Shipley. The fundamental character of the reaction between sulfur and various types of mono- and poly-olefins (including rubber) has been a frequent subject of speculation owing to its relationship to the vulcanization process, but has not hitherto been investigated. At 140° olefins in general give olefin sulfides, $R \cdot S_x \cdot R'$, in which on the average half the original unsaturation is lost and χ has values up to 6. In the sulfides from mono-olefins, R and R′ appear on an average to be mono-olefinic and saturated respectively, except that some redistribution appears to occur in the sulfides from hydroaromatic mono-olefins owing to the facility of occurrence of (probably secondary) dehydrogenation reactions. Δ 1:5-Olefins give in addition to diolefin sulfides, $R \cdot S_x \cdot R'$, cyclic monosulfides which are formed from only one molecule of olefin. Thus, polyolefins displaying suitably-spaced unsaturation become both inter- and intra-molecularly cross-linked (i.e. cyclized and vulcanized) by the sulfur taken into combination. The structural factors and chemical mechanisms which contribute to the two types of cross-linking are discussed, and also the bearing of the new information on the phenomenon of sulfur vulcanization.

Part II. Mechanism of the Reaction of Hydrogen Sulphide with Mono-olefins, Di-isoprenes, and Rubber, by Ralph F. Naylor: A study of the reactions of hydrogen sulfide with olefins is of interest to the rubber chemist both because of its possible significance in vulcanization and because of the light it sheds on the parallel reaction of sulfur with olefins. Hydrogen sulfide unites with mon- and di-olefins under pressure to give normal adducts when reaction is conducted in the presence of sulfur or a metallic sulfide as catalyst, and abnormal adducts when it is promoted under the influence of ultra-violet light. The adducts of both types include alkanethiols and alkyl sulfides and disulfides. The principal reaction products from the two di-isoprenes, dihydromyrcene and geraniolene, are cyclic sulfides of the tetrahydrothiopyran series, each being derived from a single molecule of the diolefin; corresponding products derived from two molecules of the diolefin are formed in much smaller yield. Rubber also gives sulfides of the latter (cross-linked) kind, formed by the linking of two or more polyolefin molecules by sulfur.

Part III. The Reaction of Sulphur with Squalene, by George F. Bloomfield: It is shown that sulfur reacts with squalene in a manner very similar to that observed with dihydromyrcene, and an intramolecularly-linked unimolecular sulfide as well as an intermolecularly-linked polysulfide is obtained.

Part IV. The Thermal Decomposition of Organic Polysulphides, and its Contribution to the Sulphur-Olefin Reaction, by George F. Bloomfield: At temperatures in the region of 140°, organic polysulfides (which are the primary reaction products of sulfur and olefins) decompose with fission of the S-S bonds. In the presence of olefins a considerable proportion of the fission products become attached to ethylenic centers of the olefin, forming mixed mono- and poly-sulfides. The major part of the monosulfide product is fully saturated, hydrogen-capture occurring during, or subsequent to, the formation of adducts from the olefin and sulfurated fragments; unsaturation, however, appears in the polysulfide portion. The polysulfides are capable of producing monothio-crosslinks between the original olefinic molecules only in so far as they are able to yield up elementary sulfur to the olefin, and when the original olefin is a polyisoprene the tendency towards the formation of a high proportion of intramolecular cyclic sulfide still further reduces the opportunity for formation of intermolecular sulfur-cross-linked products.

The Reaction of Sulphur and Sulphur Compounds with Olefinic Substances. Part V. Rubber Vulcanization, by George F. Bloomfield. (Publication No. 97): This paper represents an attempt to extend to rubber the previously reported work on the reaction of simpler olefins with sulfur and other vulcanizing ingredients. By vulcanization of rubber under high vacuum conditions there have been obtained data which point to the following conclusions: (1) Loss of unsaturation follows the general rule of one double bond for each sulfur atom introduced. This result is modified when zinc oxide or certain accelerators are present. (2) The vulcanization reaction is slightly inhibited by oxygen. On the other hand hydrogen sulfide and mercaptans markedly catalyze the reaction, without, however, affecting the efficiency of the sulfur cross-linking reaction. Examination of the reaction of mercaptans with sulfur has suggested that mercaptan groups formed in the initial stages of vulcanization may be converted to di- and poly- sulfide linkages when basic accelerators, zinc oxide or zinc soaps are present.

Stresses and Birefringence in Rubber Subjected to General Homogenous Strain, by L. R. G. Treloar. (Publication No. 98): The examination of the photoelastic properties of rubber is extended to the case of the most general type of strain, such as may be produced by stretching a sheet by different amounts in two directions at right angles. The observed double refraction is shown to depend in a simple way on the stretch ratios and on the applied stresses as predicted by the theory developed by the author. This result establishes the fundamental laws governing the stress-optical properties of rubber under any type of strain.

Large Elastic Deformations of Isotropic Materials. Part IV. Further Developments of the General Theory, by R. S. Rivlin. (Publication No. 101): In the previous papers of the series, a mathematical theory of the deformation of rubber-like materials was developed on the basis of a particularly simple law for the elastic behavior of the rubber which arises from the kinetic theory of the high-elasticity of rubber and is, from the mathematical point of view, the simplest law which could be employed. In this paper, many of the results previously obtained are extended to the more general case where it is assumed only that the material is incompressible and isotropic in its undeformed state.

LOS ANGELES NEWS

Registration for a course in rubber technology was scheduled for September 12 at Los Angeles City College by the Los Angeles Rubber Group, Inc. The course, "Rubber Technology I," is a non-credit course covering the basic technology of the rubber industry, including the fundamental operations of milling, calendering, extrusion and curing, and elements of compounding and physical testing. In addition, there will be discussion of design principles, specifications and the economics of rubber manufacture.

Instructors for the course are Raymond B. Stringfield, president of the Fullerton Manufacturing Co., Fullerton, Calif., and Fred Woerner, chief chemist of Los Angeles Standard Rubber Inc., Los Angeles. The first class is scheduled for September 20. In order to attend, the prospective student must be a high school graduate or 18 years old and employed in the rubber industry. Sessions will be held for three hours for 20 consecutive Wednesdays. Information may be obtained from C. L. Towers, Shell Oil Co., 1008 West 6th St., Los Angeles 17.

Herbert H. Wiedenmann, formerly production manager of the West Coast plant of the Firestone Tire & Rubber Co., has been named factory manager succeeding Clyde L. Smith, who has retired after 40 years of continuous service with the company. Mr. Weidenmann, who took over his new duties on September 1, began his career with Firestone in 1928, as a pieceworker in the Stock Preparation Department of the West Coast plant. He is a graduate of the University of Minnesota, and has done postgraduate work at the University of Southern California.

In 1929, Mr. Weidenmann was transferred to the Development Department, where he spent five years before going into the Production Department. He was made production manager in 1941, and served as manager of the Fuel Cell Division during World War II.

H. H. Wiedenmann

named Firestone factory manager

Mr. Smith began his career with the company in 1911 in the laboratories at Akron. In 1913, he was transferred to the Compounding Department. Mr. Smith went to Plant II in Akron as production manager in 1919, and two years later became manager of the Xylos Division. In 1922, he became manager of Plant I, and in 1925 he became manager of Plant II. In 1929, Mr. Smith was named assistant works manager for the company, with headquarters in Los Angeles. During the war years, Mr. Smith served as manager of the West Coast plant.

M. R. Bell, former factory manager of the rubber division of the Thermoid Co. at Trenton, N. J., has been appointed factory manager of the new plant at Downey, Calif., of the Arrowhead Rubber Company, a division of the National Motor Bearing Co., Inc. Since earning his degree in mechanical engineering from the Case Institute of Technology some seventeen years ago, Mr. Bell has spent four years with the National Carbon Co., five years with the B. F. Goodrich Co., three years with the Pharis Tire & Rubber Co., and a few years with the Thermoid Co. At Pharis, he served as manager of the Aero Division and as general manager of the Parkersburg Products Co., a subsidiary. For a short while, Mr. Bell operated his own molded goods plant in Parkersburg, West Va.

Construction of a new $300,000 addition to its present warehouse facilities at its local plant has been announced by the B. F. Goodrich Co. The building contract, awarded to the H. K. Ferguson Co., calls for a 120-day construction schedule which will put the new unit into operation by the middle of December. The new construction will give the plant a total of 645,000 square feet of floor space, with 200,000 square feet devoted to finished goods warehouse. It will be served by a double siding of the Union Pacific Railroad and will provide shipping docks for 12 railroad cars and 14 trucks at one time. The new warehouse space will be a one-story structure.

The Bridgeville, Penna., plant of the American Cyanamid Co. recently presented an 8-acre community park to the town under a token lease of $1.00 per year. It will be known as the Bridgeville-Cyanamid Park.

Plastiglove, a plastic-impregnated glove said to have wear-resistant qualities surpassing any rubber-coated glove, was recently introduced by the American Rubberizing Co., Minneapolis, Minn. Waterproof and snag-proof, the new glove is also said to be heat and flame resistant.

M. R. Bell

joins Arrowhead Rubber Company

Rudolf H. Ulrich

Dr. Rudolf H. Ulrich, formerly associated with the Rempel Manufacturing Co., Akron, Ohio, died of carbon monoxide poisoning in his garage at his home in Akron on August 4. City officials are currently conducting an investigation as to the circumstances surrounding his death, although preliminary evidence indicated that Dr. Ulrich was overcome by noxious gases while working on his automobile. Born in Germany 50 years ago, Dr. Ulrich came to the United States in 1927 and started work pushing a hand truck for the Firestone Tire & Rubber Co. At that time he held a doctor of science degree which he had acquired in Germany. Eventually he moved into the Development Department at Firestone. In 1934, he went with the General Tire & Rubber Co. In 1935, he took over development and management of General Tire's Polish subsidiary. Later, he was associated with the development of the firm's Portuguese plant. In 1949, Dr. Ulrich joined Rempel, and was assigned to developing that firm's international business. He terminated his connection with Rempel on July 1. Dr. Ulrich was a member of the Akron Chamber of Commerce, the Akron City Club and the Society of Plastics Engineers. Services were held on August 7 at the Weller Funeral Home in Akron. He leaves his wife and a son.

Boston Plans Fall Meeting

The Fall meeting of the Boston Rubber Group to be held on October 20, at the Somerset Hotel in Boston, Mass., will feature a panel discussion on compounding. The panel will be headed by Dr. John T. Blake, research director of the Simplex Wire & Cable Co., Cambridge, Mass., and will include other members of the group particularly qualified to answer compounding questions. The panel discussions will be limited to questions received by mail. Members may send their questions to H. W. Sutton, Boston Woven Hose & Rubber Co., Box 1071, Boston 3, Mass.

CANADIAN NEWS

The large rubber research center opened at Birmingham, England, recently soon may mean new and better products for Canadian motorists, sportsmen, hospitals and factories. The new center will carry out fundamental research for the whole Dunlop group of companies, including the Dunlop Tire and Rubber Goods Co., Ltd., of Toronto, and will coordinate and pass on the results of product development work in Canada and other countries where Dunlop has branch plants.

Two years ago with the purchase from Canadian Industries, Ltd., of the minority stock interest in its Canadian company, Dunlop Rubber ended an agreement through which the chemical firm had been managing its subsidiary since 1932. As a result, Dunlop Canada is now an autonomous but fully integrated member of the $200 million Dunlop group, which has 84,000 employees operating plants in 10 countries on five continents and large rubber plantations in Malaya. This closer relationship, according to D. B. Collett, vice-president and general manager of the Toronto firm, will make access to Dunlop's world-wide experience and basic research in England, always important to the Canadian company, still more significant in the years ahead.

Dunlop Canada was founded in 1894 as the American Dunlop Tire Co., Ltd., just six years after John Boyd Dunlop invented the first pneumatic tire. In 1899 a group of Canadians acquired control and the name was later changed to the Dunlop Tire and Rubber Goods Co., Ltd. In 1917 the concern passed into the hands of the Tire Investment Trust of London, which Dunlop took over in 1928.

Expanded several times since the original plant was built in 1905, the Dunlop factory in Toronto occupies about six acres at Queen St. and Booth Ave. The company also has warehouses and sales offices in Toronto and in other Canadian centers and a 55-acre site at Whitby where erection of a new plant was halted in 1947 due to the high cost of construction. Itarco, Ltd., Toronto, which manufactures bicycle tubes and tires, is a wholly-owned subsidiary. The company also has a 50 per cent interest in Canadian Lastex, Limited.

Almost all rubber products in wide demand and numerous specialty items are manufactured by Dunlop Canada. Its products include tires for automobiles, trucks and agricultural machinery, sports equipment such as golf balls, and a wide range of industrial equipment running from belting to gasoline hose. Eighteen years ago, following a policy of introducing as soon as possible to Canada new products developed by the parent concern, it launched latex foam rubber on the Canadian market. This Dunlop product is now used in automobiles, buses, theaters and hospitals and by furniture manufacturers. Bed pillows made from it, put on the market within the last few months, are being absorbed as quickly as recently expanded production facilities can turn them out.

Early this year Dunlop Canada became the first Canadian rubber concern to produce snow and standard tires for imported English cars. Its products also include aviation tires for use with Dunlop aviation equipment now being made in Canada by the Dowty Equipment Co., Ajax, under agreement with the Dunlop Aviation Division in England.

The inability of the parent company under U-K exchange restrictions to provide dollars and the increased domestic competition resulting from the loss to Canada of export markets which accounted for 40 per cent of some rubber firms' output, may slow down Dunlop Canada's expansion. New products, however, will be introduced just as soon as market conditions permit, Mr. Collett stated recently. These will include items developed by the company's Canadian research staff as well as those resulting from activities at Birmingham.

So far, Dunlop has kept mum about new British products slated for the Canadian market. Work now going forward at the big research station, however, may provide some indication of what can be expected. With 50 laboratories, an engineering building and a pilot plant, this new development is pushing research in the fields of chemistry, physics, biology, engineering and mathematics. It is concentrating, among other things, on new problems and opportunities resulting from the introduction of synthetic rubbers, new carbon blacks and synthetic elastomers and the wider use in rubber products of rayon and nylon. It is also involved in studies connected with colored rubber footwear, floor covering adapted for aircraft carrier decking, bacteria-proof rubbers for use in hospitals and the canning industry and the application of rubber to automobile body construction.

M. O. Simpson, president of Gutta Percha & Rubber, Ltd., Toronto, announced the appointment recently of H. R. Wilkes as general sales manager. Mr. Wilkes has been with the company for 35 years. For 22 years he was in charge of sales in Ontario. He succeeds C. N. Larsen, who has retired.

Berkeley V. Schaub, associated with National Adhesives (Canada), Ltd., for the past twelve years, most recently as sales manager for the Toronto plant, has been named a vice-president and director of the company in charge of the Toronto Division.

Canada Wire & Cable Co. has reported a net income of $1,003,000 for the first six months of the current year. This is equal to $6.26 a class B share and compares with $577,000, or $3.44 a share, reported for the corresponding period of 1949.

By stretching and improving processing facilities to the limit, Polymer Corporation has stepped up its synthetic rubber production to a rate in excess of 50,000 tons annually, more than enough to meet Canada's entire synthetic demand in the event of war, according to rubber trade estimates. However, it is doubtful whether this amount would all be available to Canadian manufacturers, since all U. S. and Canadian rubber production would probably be pooled and distributed through unified control.

Today, about 60% of Polymer's output is being exported. Despite a sharp increase in domestic demand in recent months, the company is continuing to honor its extensive export commitments. At any rate, Polymer is currently operating to the extent of its physical capacity, and increased supplies for the domestic market could result only from cancellation of export contracts or plant expansion.

Another round of tire price increases was generally announced early in August, led off by the B. F. Goodrich Rubber Co. of Canada. Goodrich announced increases of 15% in passenger tires, 20% in truck tires, and 5% in agricultural tires of the farm and tractor type. At the same time, increases of 10% in passenger car and truck tubes and 5% in farm and tractor tubes were announced. An increase averaging 7½% on tires and tubes was put into effect in late July. Both increases were attributed to rising costs of natural rubber.

Ethylene Oxide Unit Opened

The completion and initial operation of facilities for the production of ethylene oxide at Whiting, Ind., has been announced by the Carbide and Carbon Chemicals Division of the Union Carbide and Carbon Corp., New York 17, N. Y. The new facilities are part of the corporation's planned large-scale increase in the production of ethylene glycol. Additional facilities at Whiting now under construction are expected to be placed in operation late in the year. At its Institute, W. Va., plant, the company is already producing ethylene glycol from new units which went into operation earlier this year. Further expansion of the production capacity at this plant is also under construction which will be completed and placed in operation during the last quarter of 1950.

Introduce Ethex Accelerator

Ethex (zinc diethyl dithiocarbamate), a new accelerator for use with latex, has been introduced by the DuPont Rubber Chemicals Division, Wilmington 98, Del. Fast curing, the new material can be used as a primary accelerator in all types of dipped goods, including toys, balloons, bladders and doll skins. As a secondary accelerator, Ethex is said to be an excellent activator for Zenite and other thiazoles. Such combinations are reported to be fast curing and to impart good aging properties. Zenite-Ethex combinations are said to be especially valuable in latex thread and latex foam compounds.

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EFFICIENT in small quantities. Depending on the degree of tack to be reduced, only 1 to 6 parts on the rubber are required.

ECONOMICAL at 22c per pound, lcl quantities, fob plant.

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OBITUARIES

Samuel A. Williams

Samuel Arthur Williams, who rose through the ranks from a laborer to vice-president of the Johns-Manville Corp., died in Nashua Hospital, Nashua, N. H., on August 14. Mr. Williams, who had been retired for the past few years, was 67 years old at the time of his death. Born on Prince Edward Island, Canada, Mr. Williams moved to Brooklyn, N. Y., at the age of 20 to work as a laborer for the H. W. Johns-Manville Co. From this first post, he gradually moved up in the manufacturing departments of the company until 1908 when he became assistant to the president of the Asbestos Wood Co., a subsidiary at Nashua. Mr. Williams was successively superintendent of the asbestos plant, superintendent of the Indurated Fiber Co. at Lockport, N. Y., and executive in charge of all Johns-Manville plants in Riverdale, Ill., Lockport, N. Y., and Nashua, N. H. In 1921 Mr. Williams had charge of building the large Johns-Manville plant at Waukegan, Ill. He returned to New York as production manager of all plants in 1927 and was made a vice-president in 1929. During World War II, Mr. Williams headed the Johns-Manville Service Corp., formed at the request of the Government to build the Kansas Ordnance Plant. Under his direction the plant manufactured more than 1,000,000 tons of ammunition for the Armed Forces. His wife survives.

C. Richard Woodfill

C. Richard Woodfill, manager of the Industrial Chemicals Division of the Commercial Solvents Corp., New York, N. Y., died in Lenox Hill Hospital in New York on July 24. He was 38 years old. Mr. Woodfill joined the company in 1933, and worked in the Production Department at the Peoria, Ill., plant until 1935, when he was transferred to the Sales Department. He entered the Cleveland, Ohio, office, and three years later became its manager. Following Army service during the war, he returned as manager of the St. Louis, Ill., office before being transferred to New York in 1948 as manager of the Industrial Chemicals Division.

Lawrence B. Icely

Lawrence B. Icely, president of the Wilson Sporting Goods Co., Chicago 47, Ill., since its organization in 1918, died on August 8, in Chicago. He was 65 years old. Born in Leaf River, Ill., Mr. Icely entered the sporting goods business in 1905 as assistant manager of the Chicago Division of the Wright & Ditson Co. He remained with this firm until 1917, when he became general sales manager and secretary for the Wright & Ditson-Victor Co. His wife and daughter survive.

Frank Phillips

Frank Phillips, founder and retired chairman of the Phillips Petroleum Co., Bartlesville, Okla., died on August 23 in Atlantic City Hospital, Atlantic City, N. J. He was 76 years old. Mr. Phillips started his business career as a barber at the age of 14. In later years, he entered the banking business eventually investing in oil wells in the Bartlesville area. As his oil investments prospered, Mr. Phillips organized a number of banks in the Bartlesville area. At one time, Mr. Phillips sold his oil holdings to concentrate on the banking business, but he soon returned to the oil fields where he developed the $350,000,000 firm as it exists today. In 1937, he stepped down as president of the Phillips Petroleum Company, retaining his post as chairman of the board. He resigned the chairmanship in 1949, and devoted his remaining time to the furtherance of youth movements, particularly the Boy Scouts of America. He gave generously of his wealth to churches of all denominations and to Oklahoma civic groups. He is survived by his son and two daughters.

George L. Lawrence, Jr.

George L. Lawrence, Jr., vice-president in charge of sales of the Industrial Products Division of the Tyer Rubber Co., Andover, Mass., died on August 8 at Boothbay Harbor, Maine. Mr. Lawrence, who had been in ill health for over a year, was 63 years old. Born on July 1, 1887, in Melrose, Mass., Mr. Lawrence was a graduate of the Massachusetts Institute of Technology, class of 1909. Prior to joining Tyer Rubber in 1922, he was associated with the Boston Rubber Shoe Co., Malden, Mass., as general footwear factory production manager. He had also been associated with the McElwain Shoe Co. Mr. Lawrence came to Tyer Rubber in 1922 when that company was being reorganized and was instrumental in putting the company into the footwear business. Services were held on August 10 at his home in Melrose, followed by a private funeral.

Charles F. Blackmer

Charles F. Blackmer, former president of the American Steel & Wire Co., died on August 15 in a hospital in Atlanta, Ga. He was 72 years old. Mr. Blackmer attended the public schools of Worcester, Mass., and Cutler Academy in Colorado. He began his career in wiremaking in 1898 with the Washburn and Moen Manufacturing Co., which was later acquired by American Steel & Wire. During his career, Mr. Washburn was employed in company plants in Waukegan, Ill., Duluth, Minn., Pittsburgh, Penna., and Cleveland, Ohio. He was president of the company from 1933 to 1938. His wife survives.

Charles W. Walker

Charles W. "Doc" Walker, retired chief chemist of the American Steel & Wire Co., Cleveland 13, Ohio, died at his home in Worcester, Mass., on July 19. He started his career with American Steel in 1911 as a rubber chemist and rapidly advanced to the post he held at his retirement in 1949.

Born in Yarnell, Penna., Mr. Walker was graduated from Penn State College in 1907. His first job was with the General Electric Co. at Schenectady, N. Y., where he was designated as an analytical rubber chemist. In 1909 he joined the New Jersey

Car Spring and Rubber Co. in Jersey City, N. J., as chief chemist, and two years later went with American Steel & Wire Co.

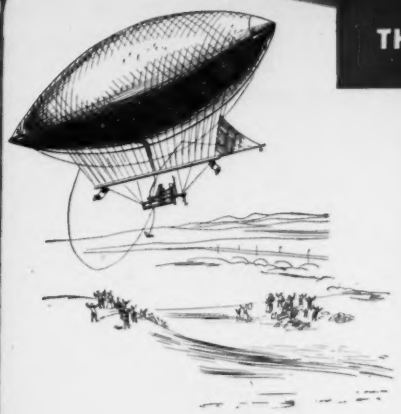
One of the pioneers of the insulated wire field, Mr. Walker had several achievements to his credit during his long association with American Steel. Thirty-four years ago he developed what was and still is regarded as the world's best insulation for submarine cables. In 1916 he originated and developed a method of rubber analysis for wire insulation and other products which was accepted as a standard for the industry. During World War II he contributed heavily toward the development of satisfactory insulations using synthetic rubber.

In his 38 years with American Steel, Mr. Walker has represented the company in numerous associations, including the American Chemical Society, American Society for Testing Materials, and the American Standards Association. He was also a member of the Joint Rubber Insulation Committee. Mr. Walker leaves his wife and daughter.

Eugene C. Floto

Eugene Carl Floto, manager of the Specifications Department of the Goodyear Tire & Rubber Co., Akron, Ohio, died on August 4 in City Hospital in Akron. He was 58 years old. Born in Myersdale, Penna., Mr. Floto had been associated with Goodyear for the past 30 years. He was a veteran of World War I, and belonged to the Twenty-Five Year Club. Services were held at the Cunningham Funeral Home in Akron with interment in Holy Cross Cemetery. His wife, four daughters and three sons survive.

THE STORY BEHIND THE WORD...



BLIMP

In the early days of von Zeppelin's experiments in lighter than air craft, a lot of work was done on small non-rigid or dirigible balloons.

Two models especially were tried. The first—the A-limp was a failure, but the second—the B-limp was a success. And thus the name for small dirigibles.

A long record of strength, stability and progressive leadership has made the word Muehlstein—the First name in Scrap Rubber.

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For wide variety of uses, high quality and uniformity these clean, bright reds are stand-outs. New, highly modernized plant and equipment and precise production controls have made them better than ever. Note these desirable characteristics.

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- Footwear
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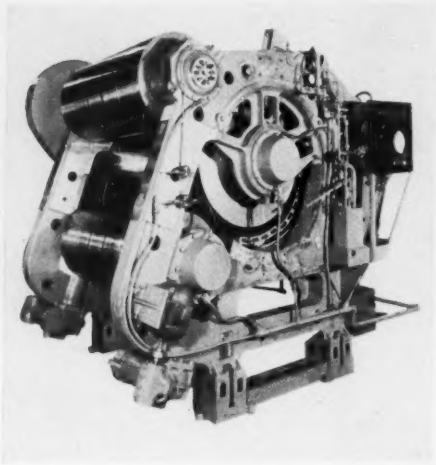
NEW EQUIPMENT

Adamson-United Rotocure

Designed to greatly facilitate removal of the vulcanizing drum and replacement of the steel band, a new Rotocure developed by the Boston Woven Hose and Rubber Co., and built by the Adamson-United Co., Akron 4, Ohio, permits roll and belt changes in a fraction of the former time. The changing of edge irons



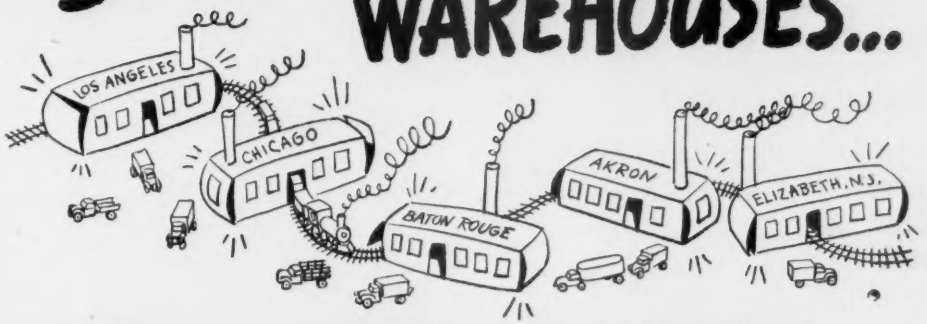
when producing conveyor or transmission belting is also facilitated in the new unit. One piece housings provide adequate "window" clearance for removal of the curing roll. A special "C" hook is furnished for supporting the roll. All supply lines are of the quick-disconnect type to further facilitate and speed roll changing.

All rolls of the unit are supported in self-aligning roller bearings and are oil flood lubricated. The speed range is adjustable from ½ to 6.2 feet per minute. The vulcanizing roll is 60 inches in diameter with an 80-inch face. The tension roll is hydraulically actuated with a maximum belt tension of 240,000 pounds. The accompanying photograph shows the front and side view of the new Rotocure.

The working surface of the vulcanizing roll is smooth and polished. It is designed for a maximum internal steam-working pressure of 150 psi to ASME code. The pressure roll is designed for a maximum internal steam working pressure of 150 psi and is surface ground. It is adjustable with relation to the vulcanizing roll through a stroke of 9 inches, by means of motorized screwdowns. The drive roll is of fabricated steel, 40 inches in diameter with an 88-inch face. This roll is fixed with respect to the vulcanizing roll and usually is not heated. The tension roll is of cast iron with a 40-inch diameter and an 88-inch face. It is not equipped with a heating chamber but is hydraulically actuated to provide tension to the steel band.

An automatic recorder-controller is provided for vulcanizing roll and steam shoes. A manual-adjusted, pres-

NOT 1 BUT 5 PARACRIL WAREHOUSES...



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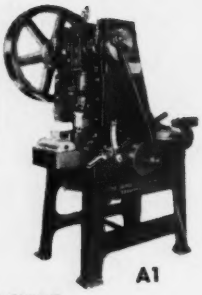
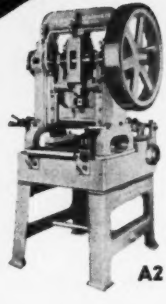
For MORE than Half a Century the name COULTER has meant MORE in higher quality cuttings . . . MORE IN GREATER PRODUCTION. So much MORE that . . .


A1

Men who Know PRODUCTION MACHINES Choose

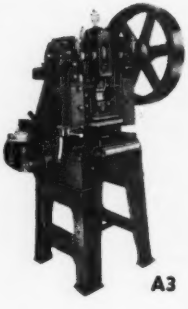
the James COULTER Machine Co.
BRIDGEPORT, CONN.

MODEL A-1
Cutting Heels at high speed production or short runs.


A2

MODEL A-2
Cutting Multiple Heels, Half and Full Soles with stock grain.

MODEL A-3
Cutting Multiple Heels and Taps with or across stock grain.


A3

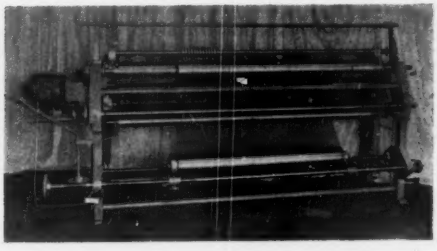
MODEL A-2s
(Not illustrated)
Cutting across grain of stock.

COULTER PRODUCTION MACHINES SINCE 1896

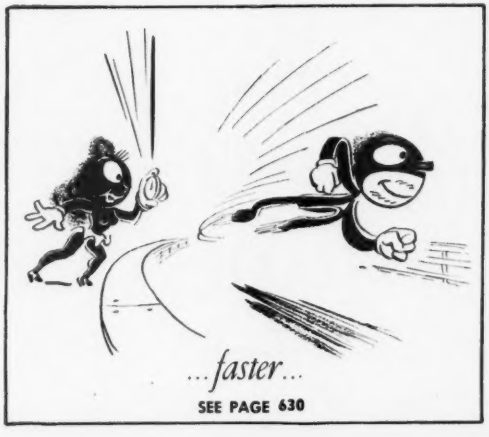
sure-reducing valve controls the pressure roll. The lubrication pump is of 15 gpm capacity and is motor operated. Five steam shoes are used, 3 by 24 by 88 inches in size, aluminum cast around 1-inch pipe coils. The inner surfaces are machined and the backs are insulated. Each shoe is pivoted at the center of each end and forced to contact with the steel band by air cylinders. The steel band is made of alloy band-saw steel, .083-inch thick by 80 inches wide by 51 feet long. The maximum band pressure on the contact area of the vulcanizing roll is 55 psi.

Center Tool Slitter-Rewinder

The Slitter-Rewinder developed by the Center Tool & Manufacturing Co., 2706 West Van Buren St., Chicago 12, Ill., will slit and rewind binding on a single or duplex shaft. The unit will slit 144 yards per minute and has a pinking attachment. The machine comes in two sizes —for 54-inch and for 72-inch material. It will slit with



rotary cutters on a hardened roll and will also slit with the use of razor blades. Equipped with a paper separator, the unit will slit binding as narrow as ½-inch. The unit is either hand operated or used with automatic web control. Sealed ball bearings which need no oiling are provided throughout.



SEE PAGE 630

NOW...CALCINED MAGNESIA

in Polyethylene bags

ready to throw into the Neoprene Mix

Baker can now supply you Magnesium Oxide, Neoprene Grade, in Polyethylene 5-pound bags packed 10 to the carton.

These highly protective bags are great time savers. They are light and easy to handle. They are always clean; need not be emptied. They dissolve right in the mix.

Moreover, these bags give added protection to the most sensitive ingredient that you use in compounding Neoprene: Magnesium Oxide (Calcined Magnesia).

The package Baker selects for Magnesium Oxide has to be good. It must protect the product from moisture with the same care that Baker uses to protect the uniformity of its Calcined Magnesia through controlled temperatures. With Baker's special electric furnaces, calcining temperatures never vary more than 5 per cent.

Temperature control, uniformity of product and packaging to prevent moisture infiltration are three of the important factors to assure Calcined Magnesia that is trouble-free for Neoprene compounding.

You get all three of these important features when you buy your Calcined Magnesia from Baker.

For test samples and prices write: J. T. Baker Chemical Co., *Executive Offices,* Phillipsburg, New Jersey.

Baker's

Baker's Chemicals

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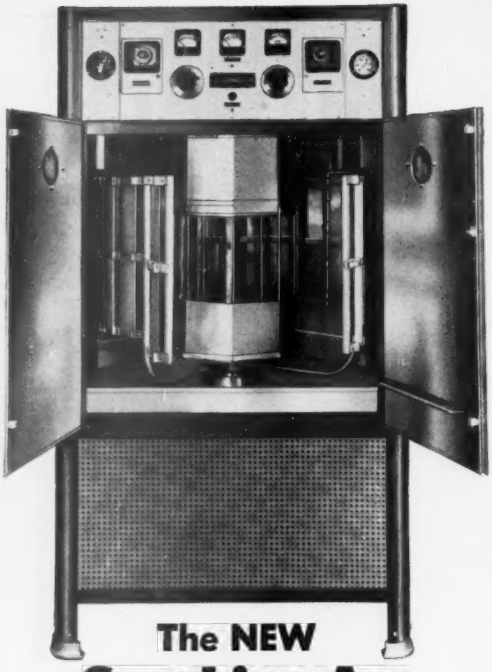


The NEW
Sunshine Arc Weather-Ometer
Type XW

A modernized and redesigned version of the open flame X-1 and X-1-A Weathering Units

Many of the control features that have proven their dependability in the Atlas Twin Arc Weather-Ometer have been combined with some features of the original X-1-A weathering unit to make a new Weather-Ometer of advanced design.

In the Type XW a new means of maintaining constant temperature is provided. Far more accurate temperature control is now available.

Radiation is from a Sunshine Carbon Arc which is of the motor-driven, open-flame type. Natural sunlight or intensified ultra-violet radiation is available depending upon the type of carbons and filters used. The light source has been improved to provide 16 hours of continuous operation as well as a number of other added conveniences.

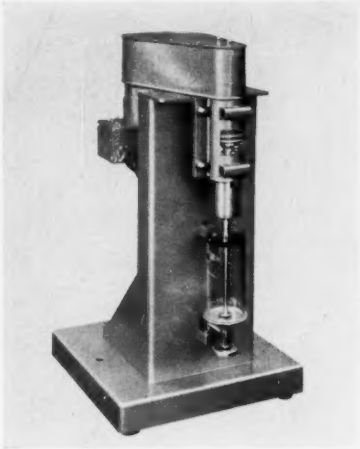
All instruments are located on a convenient control panel, including an arc voltage setting switch and meter, cycle control of light and water spray, 1 to 24 hour shut-down time switch, thermo-regulator and running time meter.

Type XW is fully automatic and may safely be left in unattended operation overnight. If deionized water is to be used, aluminum spray piping can be furnished. The capacity of the stainless steel lined testing chamber is 54 panels. The machine is sturdily constructed and is shipped assembled, ready for connection.

ATLAS ELECTRIC DEVICES COMPANY
361 West Superior St., Chicago 10, Ill.
FADE-OMETERS • LAUNDER-OMETERS • WEATHER-OMETERS

Precision Latex Test Apparatus

Designed in cooperation with the Firestone Tire & Rubber Co. and Subcommittee VII of A.S.T.M. Committee D-11, the Precision Mechanical Stability Latex Test Apparatus has been made commercially available by the Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill. The unit is designed for determining



the mechanical stability of concentrated natural latices using a high speed stirring technique.

The apparatus, as illustrated, consists of a vertical shaft high speed stirrer capable of maintaining a speed of 14,000 rpm ± 200 rpm for the duration of the test. The stirrer shaft is ¼-inch in diameter at its lowest end at the point of attachment of the agitator disc and tapers upward for a distance of 6 inches for greater strength. The stirrer spindle is precision constructed so that the agitator itself will not run out more than a total of 0.010-inch at the speed of the test. The agitator consists of a highly polished stainless steel disc 0.820-inch ± 0.001-inch in diameter and 0.062-inch ± 0.001-inch thick For attaching to the spindle shaft, the agitator is equipped with a threaded stud at its exact center.

The test jar is of Pyrex glass with a flat bottom and ground top. The dimensions are 2-5/16 inches ± 1/16-inch I. D. by 5 inches ± 1/64-inch from inside bottom to top rim of jar. Wall thickness is approximately 3/32-inch. The jar is fitted with a ⅜-inch diameter hole on the side approximately 3⅞ inches from inside bottom for sampling purposes. The mechanical stability tester is equipped with a jar holder so constructed that the jar may be conveniently inserted and at the same time the distance between the inside bottom of the jar and the bottom of the agitator disc is held at the specified distance of ½-inch and ±1/32-inch.

The spindle is driven by a ½ hp, 3,450 rpm induction motor carefully balanced and aligned to hold vibration to a minimum. The drive between the motor and the spindle is accomplished by means of proper size cone pulleys and belt for obtaining the specified spindle speed. The entire apparatus is sturdily built on a structural steel frame, finished in green hammerloid.

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6" x 12" with Anti-Friction Bearings

THE laboratory mill illustrated above was expressly designed as a precision mill for operation at high temperature (650° F).

A self contained lubrication system circulates oil through the roll journal bearings. The use of piston ring type oil seals eliminates oil leaks and the frequent replacement of rubber-based oil seals. Write for specification folder.

Capacity of mill: 2 to 3 pounds
Space required: 28" wide, 60" long.

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JOHNSON high tensile hose reinforcement wire for braided type reinforcement . . . . . High fatigue vacuum hose reinforcement wire, **Johnson** bronze plate or liquor finish. Galvanized wire for field telephone (U.S. Army specifications) . . . Music wire . . . High carbon specialty wires.

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STEEL & WIRE COMPANY, INC.
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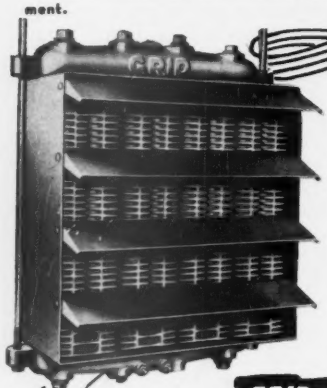
Largest Conveyor Belt Press in the World
35' by 9'—total pressure 7800 tons
G. Siempelkamp & Co., Maschinenfabrik, Krefeld, (Germany)

DO YOU Know

that it's possible

TO GO THROUGH MANY HEATING SEASONS WITHOUT UNIT HEATER MAINTENANCE EXPENSE, providing yours is a GRID installation? It's possible, and being done by major rubber plants who have investigated and installed GRID equipment.



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GRID wide fin spacing facilitates easy cleaning.

GRID will withstand steam pressures up to 250 lbs., and is free of electrolysis.

GRID fins are cast integral with the steam chamber assuring even distribution of heat. It's not possible for GRID fins to come loose from the steam chamber to cause loss of heating efficiency.

GRID design incorporating proper fan sizes, motor speeds and outlet temperatures results in a properly balanced heating unit, especially when high steam pressures are used.

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For outside air, drying, process work, GRID Blast Coils have the same high efficiency as GRID Unit Heaters . . . no tortuous air passages . . . freedom of expansion with complete absence of ruptures, strains, or warping . . . open design for easy cleaning . . . not affected by atmospheric conditions.

WRITE today for a complete GRID story on maintenance-free heating equipment for your plant.

Investigate today GRID systems of high pressure unit heaters, blast coils, and radiation . . . the answer to maintenance-free heating in the rubber industry.

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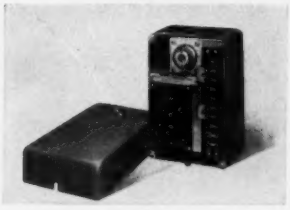
NEW EQUIPMENT (CONT'D)

G-E Electronic Timer

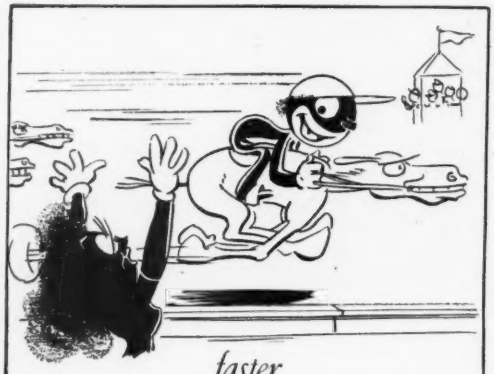
A new electronic timer developed by the Control Divisions of the Apparatus Department of the General Electric Co., Schenectady, N. Y., provides automatic control of operation, limit, and sequence timing for literally thousands of industrial processes. It is available in three time ranges: .06-1.2 seconds, .6-12 seconds, and 6-120 seconds.

The new timer features a detachable back plate which mounts directly on a rigid conduit or any flat surface. Wires are brought to the back plate and pulled through, and the timer is then mounted on the plate by means of



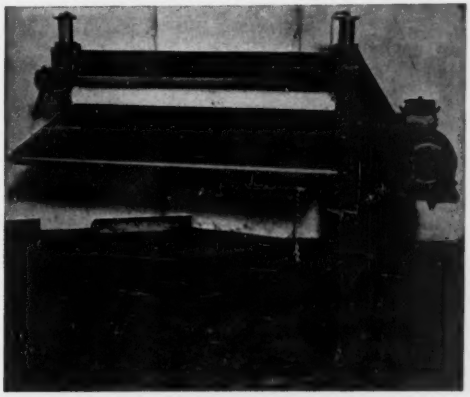
four screws. Wiring to the terminal boards completes the installation. Space between the terminal board and the cover provides adequate room for all front-connected wiring, including that for the accessories. In addition, a dual set of contacts on the timer permit control of two operations on the same time schedule.

Mechanical wear is cut to a minimum with the electronic device because the relay armature is the only moving part. The G-E 6J5 electronic tube in the timer is a standard model readily obtainable at most radio stores. Life tests conducted by G-E indicate that the new timer can perform a million or more operations at these controlled load requirements: inrush—15 amps; carry—10 amps, and break—5 amps. As the controlled load demand is reduced, more operations can be expected.



SEE PAGE 630

UTILITY
TRUCK TYPE
BAND BUILDER
BUILT UP TO 60" WIDE



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Features

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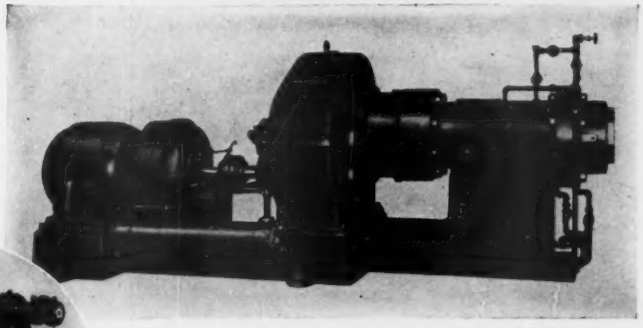
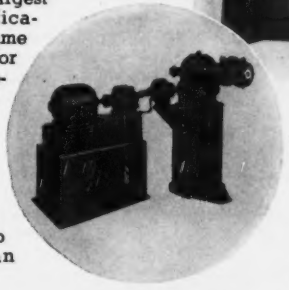
Extruders . . .

The complete facilities of National-Erie engineering, metallurgical control, foundries and machine shops enable us to meet your largest extruder specifications . . . to assume full responsibility for your extruder requirements. At the right is a National-Erie 8" standard tubing machine . . . From blue print to finished machine ready to operate you can depend upon us.





. . . *to* LAB EXTRUDERS

At the left is shown one of our 1 1/2" small production experimental extruders for rubber or plastics. Submit your rubber or plastics machine requirements to us—we shall cooperate fully and promptly.

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SYNTHETIC THICKENER FOR LATICES AND RESIN EMULSIONS

Manufacturers, compounders and consumers of natural and synthetic latices frequently ask us, "Do you have a stable, non-creaming thickener for our emulsions which will give us high viscosities at low concentrations?" Until recently, this perennial problem has been one of the banes of our existence. Now, we are pleased to announce the answer to this problem — POLYCO 296, a synthetic high polymeric thickening agent.

COMPOSITION:
POLYCO 296 is an aqueous solution of the sodium salt of an acrylic acid copolymer.

SPECIFICATIONS:

Concentration	15%
Color	Slight yellow
Turbidity	Slightly cloudy
Viscosity	Over 100,000 cps. @ 25°C
pH	8-9

GENERAL PROPERTIES:
POLYCO 296 can be diluted with hot or cold water to yield solutions with higher viscosities than possible with most commercially available synthetic thickeners. Derived solely from synthetic materials, POLYCO 296 is not subject to the rotting, souring and mildewing commonly encountered with naturally derived gums, proteins and starches.

POLYCO 296 by itself yields tough, elastic, acid-resistant films which do not embrittle or yellow with age. Because of the small quantities of this material required for effective thickening of most latices, film properties of such latices are not significantly altered.

COMPATIBLE WITH:
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Natural Latex
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ADVANTAGES:
Heat stable — will not gel at high temperatures.
High viscosities at low concentration.
Non-oxidizing, non-yellowing, flexible films.
Non-creaming, mechanically stable compounds with latices and emulsions.
Resistant to oils, fats, greases and aliphatic solvents.
Will not support bacterial growth.

SUGGESTED USES:
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4. Grinding medium for pigments.
5. Addend to emulsions paints.
6. Vehicle for textile printing pastes

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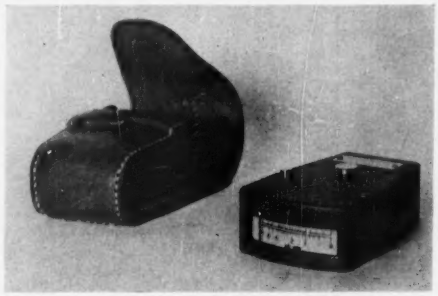
Elcometer Thickness Gage

Thickness can be measured at any point of large or small sheets of rubber, plastics, foils, etc., with the new Elcometer Thickness Gage produced by Henry A. Gardner Laboratory, Inc., 4723 Elm St., Bethesda 14, Md. The unit permits measurement of non-magnetic protective and decorative coatings applied to magnetic surfaces with an accuracy of ±5% ±.0001-inch. Measurements are not restricted to flat surfaces. The Elcometer will give readings on small radiused curves to ⅛-inch radius on a convex surface. Concave surfaces down to 1-inch radius, in shallow pressings, can be measured without difficulty. A pointer locking device is incorporated in the meter and the instrument is balanced in all planes. The Elcometer is completely self contained. No dependence whatsoever on an outside source of power is necessary. Housing of the unit is of a two-piece aluminum die-casting, finished in crackle enamel. Zero adjuster and pointer locking button are in stainless steel. Contact spheres are finished in long-wearing chrome plating. The unit is depicted herewith together with its leather carrying case.



Colonial Cutting Blocks

Adaptable for cutting any material which can be clicked or mallet cut, the Colonial Cutting Blocks manufactured by the Colonial Rubber Co., Ravenna, Ohio, a unit of the U. S. Stoneware Co., may be used on both sides. The self-healing block is made of Tygon plastic. Materials such as rubber, plastics, leather, cork, fiber, felt, cloth, paper, foils or light gauge metals can be die cut on the block surface. There is no danger of picking up chips or getting foreign material into the cut stock. Materials of different colors may be cut without cross-contamination. The cutting blocks are available in 20 by 20 by ⅜ inches and 18 by 36 by ¾-inch sizes and can be made to other sizes and of any durometer hardness on order.

The **Heat-O-Meter,** a new calculating dial for the measurement of radiation on steam and hot water heating systems, is now available from the Heat-O-Meter Co., 424 West 42nd St., New York 18, N. Y. The unit contains sizes, capacities and minimum and maximum heights on both old and new styles of radiators, mains, returns, risers, chimneys, round and sectional boilers, etc.

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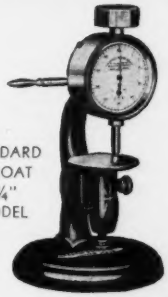

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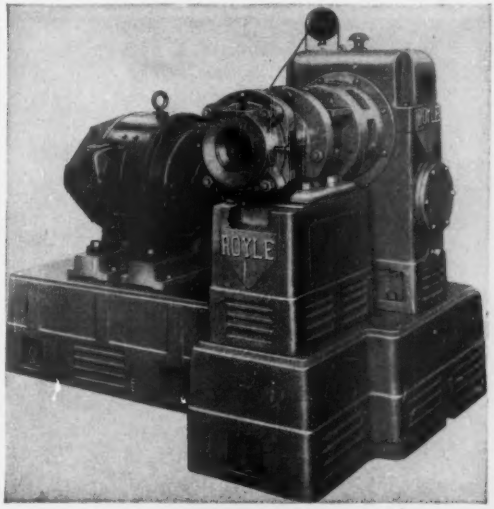
Send for your copy of Bulletin No. 448. It describes these features and how they may be applied to older type extruders.



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REVIEWS

BOOKLETS, CATALOGS, etc.

Marketing and Utilization of Rubber Latex in India. (Special Pamphlet No. 4). The Indian Rubber Board. Travancore, South India. 7¼ x 9¾ in. 24 pp.

This pamphlet offers a compilation of material on the rubber latex industry in India. The rise of the industry since 1934 is described, and a discussion offered on latex as a raw material and in its preparation for market. The marketing of both normal and concentrated latex is outlined with special attention given to sampling and containers and tanks. The properties of concentrated latex and advantages to be derived from its use are also presented. The section of the pamphlet devoted to the utilization of latex is illustrated with many photographs which depict the various uses to which the latex has been put. Other factors considered in the pamphlet are price data and information on developments. A valuable appendix and index complete this informative pamphlet.

•

Paraplex "P" Series Resins. Resinous Products Division, Rohm & Haas Co., Washington Square, Philadelphia 5, Penna. 8½ x 11 in. 24 pp.

Complete data on the uses of the Paraplex "P" series resins in the molding, laminating, potting and casting fields are presented in this booklet. Ten tables and charts define the properties of Paraplex P-43 and its high-viscosity counterpart, P-43HV, and P-13, which is flexible when cured. The booklet tabulates physical properties of the liquid and cured resins; recommends techniques for blending, laminating with glass-fiber and other reinforcements, compounding and curing, and discusses the use of fillers, pigments and dyes. Seven pages describe methods of laminating, molding, casting, fabricating, cementing, caulking and impregnating with the resins, and suggests a large number of products for which they are suited.

•

Aspects of Rubber in Engineering. Institution of the Rubber Industry, 12 Whitehall, London, S. W. 1, England. 5½ x 8½ in. 96 pp. Approximately 50c.

Six papers, originally presented at the London Section Conference held on March 17, 1950, are presented in this booklet. The papers presented include: "Factors Operating in the Measurement of the Dynamic Properties of Rubber," by W. P. Fletcher and A. N. Gent; "Measurements of the Dynamic Elasticity of Rubber," by K. W. Hillier; "Influence of Design on Rubber Springs," by A. E. Moulton and P. W. Turner; "Aspects of the Measurement of the Dynamic Properties of Rubber," by L. Mullins; "Some Theoretical Aspects of Dynamical Experiments on Rubber," by R. S. Rivlin, and "Dynamic Testing in Compression," by J. S. Waring.

•

International Rubber Statistics. By W. G. G. Kellett. Royal Statistical Society, 4 Portugal Street, London, W. C. 2, England. 6¾ x 9¾ in. 18 pp. 25c.

The information contained in this booklet has been reprinted from material which originally appeared in the "Journal of the Royal Statistical Society." The booklet deals with the statistics of the raw material and not with the various products manufactured from rubber. Principally, the booklet concerns itself with world statistical information on natural and synthetic rubber and touches lightly on reclaimed rubber. Such matters as acreage, yields per acre, seasonal variations in rubber production, productive capacities, production of synthetic latices, and much other pertinent and interesting data are presented.

Coatings From Thiokol Liquid Polymer. (Technical Service Bulletin No. 109). Thiokol Corp., 780 North Clinton Avenue, Trenton 7, N. J. 9 x 12 in. 4 pp.

This technical bulletin approaches the question of preparing a true rubber-like coating based on Thiokol LP-2. Two typical LP-2 formulations for this purpose are analyzed both as to physical properties and chemical resistance. The preparations of the formulations are discussed. Methods of application, including spraying and brushing, and the results to be derived from each, are also outlined. Test results are discussed. Much of the information presented in this bound booklet is in tabular form.

•

B. F. Goodrich Adhesives. (Catalog Section 9160). B. F. Goodrich Co., 500 South Main St., Akron 18, Ohio. 8½ x 11 in. 8 pp.

Featured by a table which lists by number each adhesive manufactured by the company, this new catalog section also specifies the materials for which they are recommended and the method by which the most effective bond is created. The catalog section also describes each adhesive, cites the recommended uses, tells the method of application, color, drying time, weight per gallon, total solids and thinner used, as well as listing the specifications it meets.

•

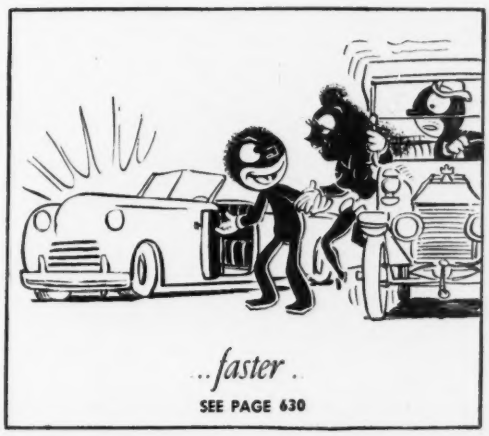
Aldrich 5-Inch Stroke Multiplex Direct Flow Pumps. (Data Sheet 64B). Aldrich Pump Co., Allentown, Penna. 8½ x 11 in. 6 pp.

Design advantages, construction, specifications and drive requirements of the 5-Inch Stroke Multiplex Direct Flow Pumps manufactured by the company are discussed in this data sheet. Also included are: a pump selection chart, dimension drawings, and plunger, pressure and capacity data on both the 5 and 7 plunger units. The applications of the pumps in industry are also discussed.

•

Research Facilities Without Capital Investment. Foster D. Snell, Inc., 29 West 15th St., New York 11, N. Y. 8½ x 11 in. 20 pp.

This brochure attempts to answer the basic question, "What is the function of the chemical consultant in today's industrial research?" Aside from illustrations of facilities and equipment, the brochure outlines briefly the relation of equipment and personnel of the consultant, and the results to be expected on various types of problems.



SEE PAGE 630

The Institution of the Rubber Industry

LONDON

THE RUBBER INDUSTRY owes its development largely to scientific and technical research and the Institution was founded in 1921 to foster scientific and technical advancement and to disseminate the results.

THE INSTITUTION TODAY is the centre of a great fraternity of rubber manufacturers, scientists, technologists, research establishments, executives and students from every country whose object is the advancement of the cause of the rubber industry throughout the world.

OBJECTS: To promote corporate and concerted effort in the industry by bringing together all those engaged or interested in the various branches of science and technology on which the Industry is based and co-ordinating their respective contributions.

To promote the profession and practice of Rubber Technology.

To encourage the extension of scientific and technical education in the principles and details of rubber manufacture.

To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publication.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

To encourage original work and research dealing with the manufacture of rubbers.

PUBLICATIONS.

The Transactions: Bi-monthly record of scientific and technological investigations in the realm of rubber and its allied industries.

Annual Report on the Progress of Rubber Technology: containing systematic accounts of the developments in rubber technology from year to year.

Proceedings of Rubber Technology Conferences.

INVITATION TO MEMBERSHIP.

At this time of progress and expansion in the affairs of the Institution, its Council, conscious of the benefits that lie within the sphere of the Institution, invites applications for the privilege of membership from those engaged or interested in the Rubber and its allied industries.

Application forms and full particulars may be obtained from:—

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INSTITUTION OF THE RUBBER INDUSTRY
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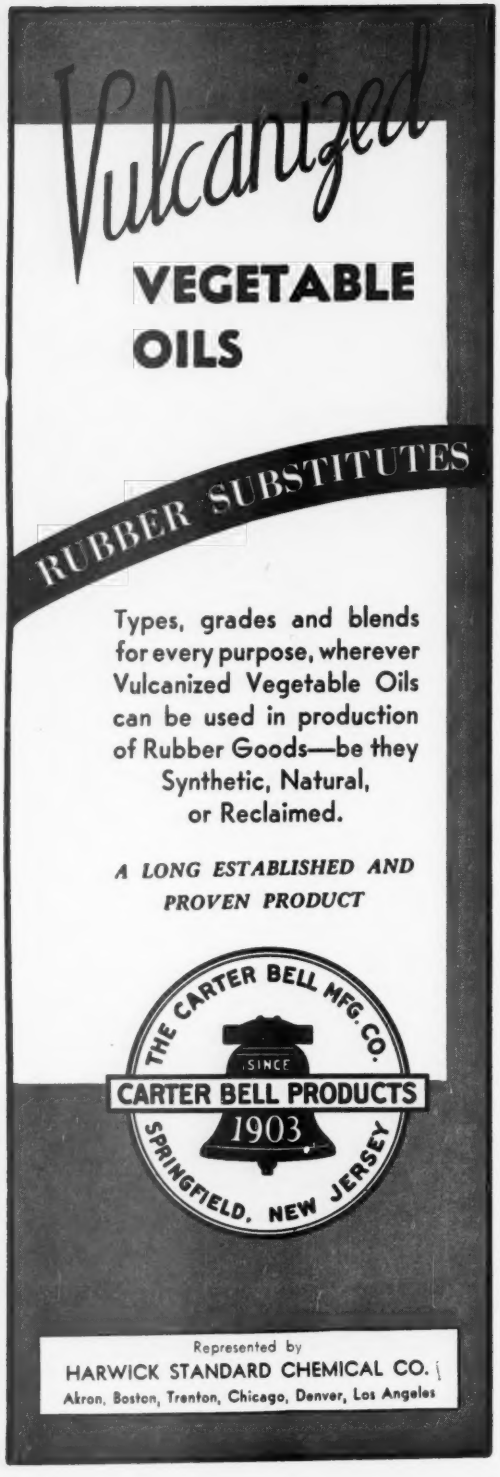
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REVIEWS (CONT'D)

Hazard Mining Cables. (Bulletin No. H-433). Hazard Insulated Wire Works, Division of the Okonite Co., Wilkes-Barre, Penna. 8½ x 11 in. 72 pp.

A unique illustrated index is featured in this new comprehensive mining cable manual. Two complete diagrams of a mine system, showing the electrical cables recommended for every mining application, provide a cross-index which greatly simplifies cable selection. A glance at this dual index will show both the cable recommended for a specific application and the uses for which each type of cable is suited. Full information and complete dimensional data are given for every type of electrical wire and cable used in or about the mines. A full line of cables is discussed, including all types of flexible cords and portable cables, boreholes and shaft cables, power transmission cables, industrial wiring, shot-firing cord and other special constructions. An additional engineering data section contains tabular data covering constructions and resistances, current carry capacities, copper characteristics and formulae used in figuring cable constructions.

•

United States Government Procurement. Trilane Associates, 1 Hudson St., New York 13, N. Y. 8½ x 11 in. 16 pp.

Designed as an aid to manufacturers in obtaining Government business, this brochure is filled with accurate, up-to-the-minute information relative to government purchasing. The brochure is divided into a number of sections, each dealing with a different aspect of procurement. An introductory section explains the various methods of procurement and advises bidders on how to obtain information relative to products or services they have to offer. The presentation of this vast amount of factual information on procurement should prove of great value not only to manufacturers who have not as yet had dealings with the government but also to those who have been and are now active government bidders.

•

Baker Plasticizers for Polyvinyl Chloride Type Resins. (Technical Bulletin 24). Sales Service Department, Baker Castor Oil Co., 120 Broadway, New York 5, N. Y. 8½ x 11 in. 7 pp.

This bulletin offers a compilation of data on the plasticization of polyvinyl chloride resins. Suggested formulations are given for clear calendered films, plastisols, spread coatings and slush molding compounds. An interesting section of the bulletin presents typical analyses of plasticizers produced by the company. Both physical and chemical properties are covered in convenient tabular form.

•

DI-tert-Butyl-para-Cresol (DBPC). (Bulletin No. C-O-115). Chemical Division, Koppers Co., Inc., Pittsburgh 19, Penna. 8½ x 11 in. 13 pp.

The physical and chemical properties, the uses, and the chemical reactions of Di-tert-Butyl-para-Cresol (DBPC) are described in this technical bulletin. A revision and expansion of an earlier bulletin published by the company, the bulletin gives technical and commercial information concerning DBPC, brief descriptions of current uses, and a bibliography of scientific references.

•

Johnson Direct Operated Solenoid Valves. (Bulletin V.) Johnson Corp., Three Rivers, Mich. 8½ x 11 in. 8 pp.

This bulletin offers a compilation of data on the company's line of direct operated solenoid valves. It lists sizes from ½-inch to 3-inches; valves for normally open or normally closed service; stainless steel or Jenkins disc seats; valves with special dot-dash construction to stop water hammer; 3-way solenoid valves, etc. Drawings of many typical installations are shown. Cross-sectional diagrams of the different units are offered together with complete dimensional data.

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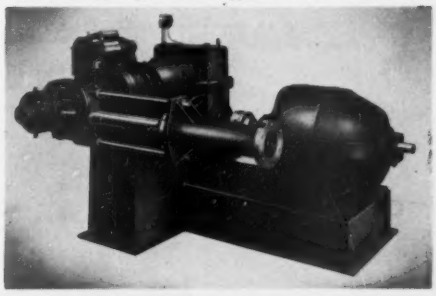
Features of this efficient equipment are: generous cylinder jacketing, new screw design, new feeder, handwheel opening splice box giving the operator plenty of room to work, improved steam seal mechanism, pressure cooling with water seal. Makes money for others, why not for you?

4½" Davis-Standard Continuous Vulcanizing Extruder, with feeder and sleeve type splice box. Opposite hand machine shown.



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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

Natural Rubber

Natural rubber prices continued their erratic course since our last report (August 10), with the price of spot rubber reaching a high of 56 cents on August 25. The low of the period, 41.50 cents, was reached on August 15, representing a differential of 14.50 cents. The average price of spot rubber for August was 51.63 cents based on 23 trading days. This compares with an average price of 39.10 in July.

Few in the rubber trade are attempting to project plans or views beyond the immediate future. Surrounding conditions are such as to make for the widespread cautiousness which prevails in all quarters. Political developments, from day to day, seem to have more influence on the market than price fundamentals.

Demands for natural rubber have been extremely modest of late as consumers in the United States analyze the probable effects of the new amendment to Allocation Order R-1. The consensus is that curtailed demand from consumers must lower the price structure for natural rubber unless stockpile purchases are made in quantity.

The Secretariat of the Rubber Study Group has reported that actual direct exports of natural rubber from the combined Far East producing areas to Russia in the first half of 1950 totaled 35,797 long tons. The figures exclude shipments from Indo-China. Total exports from the Far East in the first half of 1950 amounted to 712,780 long tons, so that the Russian portion of the total amounted to slightly more than 5%.

Today's quotations on the outside market, London and Singapore, follow:

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.53
September	.52½
October	.50½
Thin Latex Crepe:	
Spot	.55
October	.53½
Thin Brown Crepe, No. 2	.47
Ambers, No. 3	.47
Flat Bark Crepe	.41

London Market

(Standard Smoked Sheets)

October	52.50 - 53.67
December	49.29 - 49.87

Singapore Market

(Standard Smoked Sheets)

October	46.23 - 46.52

Synthetic Rubber

(Dry Types-Per Pound)

Butaprene NF	.440 - .450
Butaprene NL	.450 - .460
Butaprene NAA	.490 - .500
Butaprene NXM	.520 - 530
Chemigum 30 N4NS	.400 - .470
Chemigum 50N4NS	.400 - .470
Chemigum N3	.450 - .520
GR-I	—— - .185
GR-S	—— - .185
Hycar OR-25	.450 - .460
Hycar OR-15	.520 - .530
Hycar OS-10	.500 - .510
Neoprene Types CG and AC	—— - .500
Neoprene Type E	—— - .650
Neoprene Types FR and KNR	—— - .750
Neoprene Type GN	—— - .350
Neoprene Type GN-A	—— - .350
Neoprene Type RT	—— - .370
Neoprene Type S	—— - .350
Neoprene Type W	—— - .370
Paracril 18	.430 - .450
Paracril 26	.440 - .460
Paracril 35	.510 - .530
Silastic (compounded)	2.35 - 4.40
Thiokol Type A	.370 - .470
Thiokol Type FA	.520 - .620
Thiokol PR-1	.750 - .850
Thiokol Type ST	.750 - .850

NEW YORK, SEPT. 6, 1950

Scrap Rubber

Increases in demand for scrap rubber evidenced during the past few months have continued during the current period. Reclaimers are taking substantial tonnages of scrap. Temporary shortages have been noted in several grades. In accordance with the strengthened market, prices for scrap rubber have been adjusted to more accurately picture the present situation. Current quotations follow:

Mixed passenger tires	ton	$28.00
Beadless truck tires	ton	nom.
Mixed truck tires	ton	30.00
Beadless passenger tires	ton	nom.
No. 1 passenger peelings	ton	60.00
No. 1 truck peelings	ton	60.00
Red passenger tubes	lb.	.12
Black passenger tubes	lb.	.09
Mixed passenger tubes	lb.	.06½
No. 2 truck tubes	lb.	nom.
Red truck tubes	lb.	.12
Black truck tubes	lb.	.09
Buffings	ton	30.00

Reclaimed Rubber

Consumption of reclaim for the month of July was estimated at 22,307 long tons by the Department of Commerce, compared with the 25,253 tons consumed in the previous month. Trade circles are of the opinion that recent Government restrictions on the consumption of natural and synthetic rubber may boost reclaim production to 300,000 tons a year. Under present conditions, the total manufacturing capacity of the reclaim industry may soon be taxed to the limit. Current quotations follow:

Tires

Black, Digester (Natural)	lb.	.09 - .09½
Peels No. 1	lb.	.09½ - .10
Whole Tire (Blend)	lb.	.08¾ - .09¼

Inner Tubes

Black (Natural)	lb.	.15 - .16½
Red (Natural)	lb.	.17½ - .18
Butyl	lb.	.10½ - .11

Shoe

Unwashed (Natural)	lb.	.08¾ - .09¼

Cotton Tire Fabrics

The present expansion of the armed forces added to the continued strong demand for passenger and commercial vehicles has increased the market demand for cotton tire fabrics. Tire manufacturers, faced with a shortage of rayon high tenacity yarn, have been forced to return to the use of cotton fabrics to some extent. There has been some discussion over the prospects of a Government allocation program to insure deliveries of tire cord of all types. Prices have been adjusted to reflect present conditions. Current quotations follow:

Standard, Peeler, 12/4/2	lb.	.81
Standard, Peeler, 14/4/2	lb.	.82
Standard, Peeler, 16/4/3	lb.	.85
Extra Staple, Peeler, 12/4/2	lb.	.94
Extra Staple, Peeler, 14/4/2	lb.	.96
Extra Staple, Peeler, 16/4/3	lb.	.99

Chafers

14.4 oz. (per sq. yard)	lb.	.77½
9.25 oz. (per sq. yard)	lb.	.74
11.65 oz. (per sq. yard)	lb.	.71
13.9 oz. (per sq. yard)	lb.	.76

Cotton

The market for middling uplands on the Cotton Exchange has moved in a range of 2.85 cents since our last report (August 10), high for the period being 41.15 cents reached on September 6, and low being 38.30 cents reached on August 15. The average price of middling uplands for the month of August was 38.93 cents based on 23 trading days. This compares with an average of 38.11 cents in July.

The Agriculture Department, on September 6, announced the sale of 576,393 bales of 1948 crop-pooled cotton acquired by the Commodity Credit Corporation under the price support program. The amount paid was not announced. The cotton cost the CCC more than $150 a bale. Under law it can be sold for no less than the current support price, plus 5% and reasonable carrying charges. To date, 1,997,126 bales of the 1948 crop-pooled cotton have been sold. Originally, there were 3,781,000 bales in the pool.

The supply of United States cotton for the 1950-51 season has been estimated at 16,800,000 bales by the Department of Agriculture, 4,750,000 less than in the 1949-50 season. This supply, however, is about 2,000,000 bales more than the total consumption in 1949-50. The forecast for the 1950 cotton crop is 10,308,000 bales, compared with the 1949 crop of 16,128,000. The 1950-51 estimate includes an August 1 carryover of 6,500,000 bales. Cotton exports in the year ended in July totaled 5,905,000 bales, 1,158,000 more than in 1948-49.

Quotations for middling uplands on the Exchange follow:

	Aug. 10	September 6		
	Close	High	Low	Close
Oct.	38.01	40.57	40.18	40.28
Dec.	38.13	40.62	40.25	40.28
Mar.	38.14	40.83	40.40	40.46

Closing Rubber Prices on New York Commodity Exchange

(No. 1 R.S.S. Contract)

FROM AUGUST 11 TO SEPTEMBER 6

Aug.	Spot	Sept.	Dec.	Mar.	May	Sales
11	45.00	48.30	40.39	34.90	32.50	66
12	——	——	——	——	——	——
13	——	——	——	——	——	——
14	44.50	46.30	38.39	33.00	31.00	40
15	41.50	44.30	37.25	33.50	31.70	51
16	42.50	42.70	39.25	35.50	33.70	167
17	45.50	43.75	39.75	37.50	35.70	149
18	47.50	44.00	39.85	37.75	35.70	66
19	——	——	——	——	——	——
20	——	——	——	——	——	——
21	47.00	45.75	41.25	38.10	36.10	22
22	49.00	47.75	43.25	40.10	38.10	35
23	51.00	49.75	45.25	42.10	40.10	19
24	55.00	51.75	47.25	44.10	42.10	48
25	56.00	49.75	46.00	43.00	41.00	68
26	——	——	——	——	——	——
27	——	——	——	——	——	——
28	53.50	51.75	47.40	44.20	42.30	73
29	54.00	52.00	47.45	43.90	41.50	30
30	53.50	49.50	45.45	41.90	39.50	104
31	51.50	47.75	44.25	41.25	39.25	89
Sept.						
1	50.50	48.25	44.90	42.25	40.25	11
2	——	——	——	——	——	——
3	——	——	——	——	——	——
4	——	——	——	——	——	——
5	51.50	50.50	46.90	44.25	42.25	47
6	53.00	52.50	48.50	46.25	44.25	59

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS												
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule				RE-EXPORTS		TOTAL NET IMPORTS
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,640	125,373,864	14.08	11,944	4,168,127	15.58	2,508	628,886	11.19	412,092	5,652	1,799,124	406,440
1939	469,946	167,586,780	15.92	27,437*	10,467,552	17.03	2,233	463,345	9.27	499,616	13,125	5,832,618	486,491
1940	781,202	303,308,823	17.33	33,789	14,593,466	19.28	3,633*	758,007	9.31	818,624	7,060	3,197,136	811,564
1941	989,498	401,976,317	18.14	34,797*	15,965,627	20.48	4,881	1,145,767	10.48	1,029,176	5,376	2,757,872	1,023,800
1942	266,276	112,537,426	18.87	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,445	10,856	5,913,386	271,589
1943	50,358	31,369,198	27.81	1,890	1,312,202	31.00	7,678*	3,636,789	21.14	59,926	22,583	16,446,707	37,343
1944	103,847	73,908,549	31.77	3,091	2,092,211	30.99	6,701*	3,351,233	22.33	113,639	9,739	8,712,695	103,900
1945	134,408	95,814,102	31.82	4,733	3,115,853	30.22	10,040	5,963,797	26.52	149,221	9,509	7,201,746	139,712
1946	366,415	222,552,939	27.12	8,421	5,843,085	29.14	5,344	2,859,246	23.89	380,180	7,711	5,331,954	372,469
1947	691,087	306,951,814	19.83	17,542	9,787,722	30.98	2,884	1,492,825	23.11	711,513	4,121	2,354,494	707,392
1948	702,293	290,849,177	18.49	32,745	9,820,080	24.93	302	71,330	10.53	735,340	6,672	3,259,324	728,668
1949	630,818	225,341,459	15.95	29,974	14,970,478	22.30	....	.....	....	660,792	6,253	2,746,109	654,539
1948:													
Nov.	49,800	22,292,055	19.98	813	466,095	25.59	....	.....	....	50,613	772	349,315	49,841
Dec.	**83,419**	**35,495,327**	**19.00**	**4,216**	**2,366,959**	**24.75**	....	.....	....	87,635	569	250,540	87,066
1949:													
Jan.	**66,575**	**27,037,698**	**18.13**	**1,132**	**634,165**	**25.02**	....	.....	....	**67,707**	**757**	**320,036**	**66,950**
Feb.	**55,234**	**21,549,791**	**17.41**	**2,159**	**1,030,107**	**21.30**	....	.....	....	**57,393**	**434**	**211,323**	**56,959**
Mar.	53,768	20,095,422	16.68	2,809	1,564,383	24.87	....	.....	....	56,577	562	245,780	56,015
Apr.	48,262	18,167,840	16.85	2,271	1,219,404	23.97	....	.....	....	50,533	315	165,632	50,218
May	51,243	18,827,018	16.40	2,191	1,105,887	22.54	....	.....	....	53,434	390	181,457	53,044
June	49,038	18,084,566	16.47	2,180	1,113,169	22.80	....	.....	....	51,218	471	226,882	50,747
July	43,474	15,502,688	15.76	2,267	1,146,784	22.59	....	.....	....	45,741	699	289,896	45,042
Aug.	46,853	15,828,526	15.08	2,725	1,342,109	21.98	....	.....	....	49,578	251	110,368	49,327
Sept.	43,476	14,069,331	14.45	2,144	1,095,225	22.81	....	.....	....	45,620	556	248,921	45,064
Oct.	44,651	14,678,475	14.66	2,634	1,213,360	20.57	....	.....	....	47,285	404	160,047	46,881
Nov.	63,641	20,693,593	14.51	3,512	1,645,360	20.89	....	.....	....	67,153	11	9,002	67,142
Dec.	63,982	20,770,607	14.49	3,952	1,860,525	21.02	....	.....	....	67,934	689	295,362	67,245
1950:													
Jan.	54,277	17,881,882	14.71	3,974	1,951,793	21.92	....	.....	....	58,251	431	225,196	57,820
Feb.	50,022	17,373,658	15.51	3,336	1,608,163	21.52	....	.....	....	53,358	558	252,013	52,800
Mar.	57,831	21,120,712	16.30	3,650	1,826,747	22.34	....	.....	....	61,481	659	326,688	60,822
Apr.	72,418	27,412,444	16.89	4,395	2,199,149	22.34	175	47,117	12.02	76,988	639	340,781	76,349

Source: U. S. Department of Commerce. * Adjusted to agree with total gross imports.

Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. (3) In the years 1940 through 1943, crepe sole rubber imports were reported under a separate classification. Such imports, which are included under natural rubber, dry above, were: 856,294 pounds, valued at $191,097 in 1940; 379,607 pounds, valued at $85,924 in 1941; 662,503 pounds, valued at $159,530 in 1942; and 21,653 pounds, valued at $5,215 in 1943.

Natural Rubber
(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	**488,145**	**575,000**	**12,581**	**223,000**
1937	**600,479**	**543,600**	**7,902**	**262,204**
1938	**411,983**	**437,031**	**5,652**	**231,500**
1939	**499,473**	**592,000**	**13,125**	**125,800**
1940	**818,243**	**648,500**	**7,060**	**288,864**
1941	**1,029,007**	**775,000**	**5,376**	**533,344**
1942	**282,653**	**376,791**	**10,856**	**422,714**
1943	**55,329**	**317,634**	**20,815**	**139,594**
1944	**107,834**	**144,113**	**9,665**	**93,650**
1945	**135,672**	**105,429**	**6,743**	**118,715**
1946	**400,687**	**277,597**	**4,338**	**237,467**
1947	**688,354**	**562,661**	**4,101**	**129,038**
1948	**735,227**	**627,332**	**6,673**	**141,541**
1949	660,792	574,522	6,253	106,619
1948:				
Dec.	87,634	45,985	569	141,541
1949:				
Jan.	**67,706**	**50,188**	**757**	**125,050**
Feb.	**57,401**	**46,285**	**434**	**118,803**
Mar.	**56,577**	**53,108**	**562**	**117,664**
Apr.	50,533	47,859	315	112,916
May	53,510	46,128	390	111,875
June	51,218	47,117	471	103,626
July	46,277	40,597	699	103,017
Aug.	49,579	45,307	251	99,850
Sept.	45,620	43,978	556	100,618
Oct.	47,285	51,243	404	90,733
Nov.	67,152	52,093	701	99,208
Dec.	67,934	52,919	713	106,619
1950:				
Jan.	58,251	59,992	431	108,769
Feb.	53,393	56,580	558	104,477
Mar.	61,481	60,859	659	101,691
Apr.	76,998	57,914	639	106,124
May	60,699	63,813	597	100,776
June	77,876	63,333	625	99,457
July	61,666	60,394	575	93,526

Source: 1936-40, U. S. Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.

U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	535,643
1937	354	151,344	7,109	2,017,786	1,122	440,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,954,001	1,783	607,025
1942	1,544	1,107,059	1,200	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1948:						
Nov.	86	49,155	48	36,634	20	10,572
Dec.	83	56,896	106	108,975	24	12,324
1949:						
Jan.	46	29,922	91	93,738	19	11,934
Feb.	65	53,665	77	91,362	9	16,328
Mar.	136	86,499	60	52,313	5	30,967
Apr.	88	48,244	14	8,753	16	9,878
May	103	60,361	85	83,291	..	.....
June	44	20,821	74	47,515	27	16,292
July	164	78,112	46	37,403	5	3,391
Aug.	137	66,002	114	96,509	5	2,218
Sept.	208	122,732	91	74,605	22	31,672
Oct.	222	142,538	123	92,681	19	15,221
Nov.	77	68,678	160	89,806	34	28,559
Dec.	54	36,980	108	67,002	39	24,061
1950:						
Jan.	61	42,855	37	18,308	56	35,288
Feb.	42	24,040	162	123,570	30	20,291
Mar.	90	66,374	113	97,008	17	13,672
Apr.	68	45,844	246	211,744	30	23,369
May	78	50,093	114	103,796	69	86,151

Source: U. S. Department of Commerce.

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Organic Chemicals Division
Dewey and Almy Chemical Company
Cambridge 40, Massachusetts

Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	572	1,702
1942	22,434	.....	17,651	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,043	566,670	104,266	142,927
1945	820,373	10,407	693,580	83,778	203,454
1946	740,026	7,709	761,699*	72,920	114,963
1947	508,702	1,093	559,566	11,385	62,366
1948	488,343	15,671	442,072	4,874	115,111
1949	393,690	17,242	390,855	6,483	98,042
1949:					
Nov.	28,619	1,707	31,684	459	101,430
Dec.	27,234	1,578	32,277	352	98,205
1950:					
Jan.	22,178	1,659	33,966	546	92,284
Feb.	29,336	2,035	31,860	577	88,381
Mar.	33,003	2,569	36,647	621	86,824
Apr.	34,821	2,302	38,075	711	83,440
May	37,320	2,762	43,866	620	74,524
June	38,569	2,433	46,011	622	65,346
July	43,820	2,239	41,216	625	66,980

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated. * Includes year-end adjustment of 5,384 tons to cover non-reporting companies.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1942	3,721	8,956	23	9,734	22,434
1943	182,259	33,603	1,373	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	405,492	34,848	56,662	7,012	504,014
1949	310,599	35,215	54,046	11,072	410,932

Consumption

1942	2,529	6,833	22	8,217	17,651
1943	131,977	26,205	304	12,405	170,891
1944	495,552	46,243	10,763	14,112	566,670
1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666
1948	345,313	32,118	58,870	5,771	442,072
1949	299,420	31,753	50,855	8,827	390,855

Exports

1942	222	1,037	..	160	1,419
1943	14,937	2,540	40	631	18,148
1944	98,380	4,799	530	557	104,266
1945	76,555	3,837	980	406	83,778
1946	68,763	2,642	495	797	72,697
1947	7,951	2,617	62	755	11,385
1948	1,093	2,875	21	885	4,874
1949	1,401	3,330	178	1,574	6,483

Stocks at End of Period

1942	1,050	1,786	4	1,772	4,612
1943	30,975	6,415	1,033	3,145	41,568
1944	116,130	11,739	9,892	5,166	142,927
1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,755	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	96,282	5,072	10,995	2,762	115,111
1949	77,731	4,654	12,224	3,433	98,042

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1943	1944	1945	1946	1947	1948	1949	1950
Jan.	36,085	47,540	52,008	51,746	57,057	61,308	63,083	66,908
Feb.	36,274	47,754	48,856	47,654	50,551	56,487	57,934	63,366
Mar.	41,586	52,263	55,364	56,703	59,947	68,171	73,118	78,739
Apr.	48,177	50,005	59,024	62,111	64,140	72,183	75,279	80,348
May	49,828	54,230	60,748	66,800	70,865	77,186	81,622	89,033
June	53,325	54,266	60,580	63,247	71,329	78,044	83,338	90,010
July	49,867	55,119	60,076	73,441	81,428	82,118	.....	.....
Aug.	51,880	55,618	70,058	66,729	72,089	80,351	84,632	.....
Sept.	49,707	56,318	64,529	62,268	71,384	76,159	80,760	.....
Oct.	53,111	53,154	55,708	66,637	73,277	75,164	79,253	.....
Nov.	50,703	54,967	53,543	61,345	64,158	72,560	76,270	.....
Dec.	48,695	52,250	49,745	61,101	67,506	72,162	75,470	.....
Total	568,238	633,482	696,333	735,417	795,015	871,270	912,877	.....

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption—Tons	Consumption—% to Crude *	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007[b]	254,820	64.6	30,405	42,532
1943	304,058[c]	291,082	59.6	15,678	46,201
1944	260,631[d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1949:					
June	18,849	19,316	23.0	694	30,684
July	14,626	15,966	22.6	681	29,126
Aug.	17,813	19,297	24.2	612	27,526
Sept.	18,304	18,517	24.2	761	26,257
Oct.	20,683	19,638	23.3	1,107	26,619
Nov.	19,382	18,512	22.1	796	27,801
Dec.	19,723	18,210	21.5	702	28,263
1950:					
Jan.	19,472	20,106	21.4	902	27,319
Feb.	20,474	19,741	22.2	790	27,256
Mar.	23,137	22,151	22.5	988	27,602
Apr.	22,716	21,318	22.2	982	28,352
May	24,879	24,158	21.9	881	27,837
June	25,960	25,253	22.7	889	28,470
July	24,367	22,307	21.6	900	29,861

Source: 1936-40, Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1930	2,784,745	571,241	3,355,986	1940	3,692,328	721,637	4,413,965
1931	1,973,090	416,648	2,389,738	1941	3,744,500	875,381	4,619,681
1932	1,135,491	235,187	1,370,678	1942	220,814	133,083	353,897
1933	1,573,512	346,545	1,920,057	1943	0	4,501	4,501
1934	2,177,919	575,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1949:							
Jan.	326,019	104,599	430,618	July	483,261	95,348	578,609
Feb.	324,547	101,700	426,247	Aug.	557,370	99,850	657,220
Mar.	402,402	115,171	517,573	Sept.	534,493	91,389	625,882
Apr.	436,392	106,212	542,604	Oct.	487,891	84,704	572,595
May	394,703	86,200	480,903	Nov.	381,951	72,749	667,881
June	493,882	99,126	593,008	Dec.	285,930	66,688	352,618
1950:							
Jan.	487,824	93,323	581,147	July	595,067	111,028	706,095
Feb.	385,361	89,971	475,332	Aug.	.....	.....	.....
Mar.	469,618	110,843	580,461	Sept.	.....	.....	.....
Apr.	455,193	103,850	559,043	Oct.	.....	.....	.....
May	575,518	120,963	696,481	Nov.	.....	.....	.....
June	720,688	135,332	856,020	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1945	1946	1947	1948	1949
Passenger Car	4,504,368	15,058,469	21,346,004	23,842,796	27,715,344
Truck & Bus	6,386,652	5,939,244	7,737,353	6,920,231	4,238,174
Agricultural	1,441,909	1,735,992	2,633,699	3,140,882	2,695,430
Earth Mover	1,308	5,520	10,610	13,330	9,895
Total	12,434,237	22,739,225	31,727,666	33,917,239	34,658,843

	1950				
	Feb.	Mar.	Apr.	May	June	July
Passenger Car	2,312,926	2,368,168	2,301,389	2,956,585	3,558,246	3,382,532
Truck & Bus	449,357	525,330	468,314	562,659	614,415	620,192
Agricultural	225,703	271,077	310,142	266,483	226,468	193,551
Earth Mover	578	576	476	1,514	2,697	1,041
Total	2,988,564	3,165,151	3,080,321	3,787,241	4,401,826	4,197,316

Source: The Tire & Rim Association, Inc.

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TEAR

the tear resistance of No. 1 Smoked Sheets can be *doubled* with

Wyandotte Ultra-fine Precipitated Calcium Carbonate
(or PURECAL *U—our new name for this chemical)

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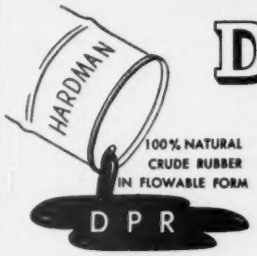

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BRANCHES: CHICAGO, ILL. AKRON, O. DETROIT, MICH. LOS ANGELES, CAL.

Natural and Synthetic

Latex and Latex Compounds

for all purposes

Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1938 (total)	**11,516**	**30,567**	**1,049**	**43,132**	**40,907**	**8,451**
Passenger Car	**10,086**	**27,104**	**580**	**37,770**	**35,789**	**6,937**
Truck and Bus	**1,430**	**3,463**	**469**	**5,362**	**5,118**	**1,514**
1939 (total)	**18,208**	**38,022**	**1,279**	**57,509**	**57,613**	**8,665**
Passenger Car	**15,742**	**33,471**	**607**	**49,820**	**49,933**	**7,108**
Truck and Bus	**2,466**	**4,551**	**672**	**7,689**	**7,680**	**1,557**
1940 (total)	**22,252**	**35,346**	**1,176**	**58,774**	**59,186**	**9,127**
Passenger Car	**19,560**	**30,903**	**411**	**50,874**	**50,965**	**7,270**
Truck and Bus	**2,692**	**4,443**	**765**	**7,900**	**8,221**	**1,857**
1941 (total)	**24,780**	**39,895**	**1,489**	**66,164**	**61,340**	**4,436**
Passenger Car	**19,855**	**34,119**	**586**	**54,560**	**50,392**	**3,165**
Truck and Bus	**4,925**	**5,776**	**903**	**11,604**	**11,148**	**1,271**
1942 (total)	**6,680**	**8,872**	**207**	**15,759**	**15,351**	**6,247**
Passenger Car	**910**	**2,734**	**38**	**3,682**	**2,790**	**4,432**
Truck and Bus	**5,770**	**6,138**	**169**	**12,077**	**12,561**	**1,815**
1943 (total)	**6,128**	**18,547**	**225**	**24,900**	**20,423**	**1,883**
Passenger Car	**82**	**10,606**	**71**	**10,759**	**7,620**	**1,132**
Truck and Bus	**6,046**	**7,941**	**154**	**14,141**	**12,803**	**751**
1944 (total)	**6,654**	**26,439**	**263**	**33,356**	**33,446**	**2,013**
Passenger Car	**208**	**18,330**	**130**	**18,668**	**18,819**	**1,218**
Truck and Bus	**6,446**	**8,109**	**133**	**14,688**	**14,627**	**795**
1945 (total)	**5,984**	**36,479**	**504**	**42,967**	**44,524**	**3,077**
Passenger Car	**1,115**	**25,463**	**222**	**26,800**	**28,200**	**2,214**
Truck and Bus	**4,869**	**11,016**	**282**	**16,167**	**16,324**	**863**
1946 (total)	**15,310**	**65,490**	**1,512**	**82,312**	**82,298**	**2,448**
Passenger Car	**11,086**	**54,684**	**653**	**66,423**	**66,466**	**1,763**
Truck and Bus	**4,224**	**10,806**	**859**	**15,889**	**15,832**	**685**
1947 (total)	**25,056**	**62,871**	**3,256**	**91,183**	**95,550**	**6,949**
Passenger Car	**19,644**	**52,857**	**1,608**	**74,109**	**77,795**	**5,444**
Truck and Bus	**5,412**	**10,014**	**1,648**	**17,074**	**17,755**	**1,505**
1948 (total)	**26,845**	**49,148**	**1,787**	**77,781**	**81,314**	**10,698**
Passenger Car	**21,589**	**41,295**	**656**	**63,540**	**66,738**	**8,773**
Truck and Bus	**5,256**	**7,853**	**1,132**	**14,241**	**14,576**	**1,925**
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger Car	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950:						
Mar. (total)	2,830	3,858	106	6,794	7,314	12,355
Passenger Car	2,484	3,127	42	5,654	6,172	10,332
Truck and Bus	345	731	64	1,140	1,142	2,022
April (total)	2,975	4,438	112	7,526	7,583	12,341
Passenger Car	2,648	3,695	53	6,396	6,469	10,354
Truck and Bus	327	744	59	1,129	1,114	1,987
May (total)	3,119	5,296	106	8,521	8,629	12,367
Passenger Car	2,733	4,498	46	7,277	7,369	10,365
Truck and Bus	386	798	60	1,244	1,260	2,002
June (total)	4,056	6,032	114	10,202	8,480	10,762
Passenger Car	3,605	5,151	48	8,804	7,311	8,987
Truck and Bus	450	882	66	1,398	1,169	1,775

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton				Rayon and Nylon[b]		
	Tire Cord Not Woven	Cord Fabric Woven	Chafer and All Other Tire Fabrics	Total	Tire Cord Not Woven	Tire Cord And Other Tire Fabrics	Total
1947:							
Jan.-Mar.	**21,972**	**49,377**	**21,815**	**93,164**	**5,322**	**52,059**	**57,381**
Apr.-June	**23,491**	**53,746**	**16,480**	**93,717**	**5,486**	**47,360**	**52,846**
July-Sept.	**15,571**	**44,291**	**14,596**	**74,458**	**6,161**	**51,719**	**57,880**
Oct.-Dec.	**18,183**	**48,532**	**17,762**	**84,477**	**6,550**	**55,078**	**61,628**
Total	**79,217**	**195,946**	**70,653**	**345,816**	**23,519**	**206,216**	**229,735**
1948:							
Jan.-Mar.	**18,546**	**50,251**	**19,391**	**88,188**	***a***	**60,569**	**60,569**
Apr.-June	**15,585**	**45,385**	**18,213**	**79,183**	***a***	**59,759**	**59,759**
July-Sept.	29,743	45,927	*c*	75,670	*a*	63,642	63,642
Oct.-Dec.	13,321	34,424	15,879	63,624	*a*	65,258	65,258
Total	77,195	175,987	53,483	306,665	.....	249,228	249,228
1949:							
Jan.-Mar.	*d*	33,213	25,395	56,608	*a*	68,296	68,926
Apr.-June	5,309	29,114	13,617	48.040	*a*	68,269	68,269
July-Sept.	1,343	16,620	11,141	29,104	15,640	55,969	71,609
Oct.-Dec.	180	17,650	11,886	29,716	12,967	58,890	72,857
Total	6,832	96,597	62,039	163,468	28,607	251,424	281,661
1950:							
Jan.-Mar.	3,939	19,210	12,948	36,097	12,469	60,981	73,450
Apr.-June	11,077	29,498	14,071	54,646	11,510	59,966	71,476
July-Sept.	.....	.....	.....	.....	.....	.....	.....
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1936	21,514	32,188	721	54,423	57,036	10,945
1937	22,464	29,554	749	52,767	52,373	10,312
1938	11,515	28,134	644	40,293	37,848	8,166
1939	18,190	31,998	1,002	51,190	50,649	7,036
1940	22,172	29,070	972	52,214	52,237	7,017
1941	24,722	33,749	1,232	59,703	57,433	4,686
1942	6,895	7,213	159	14,267	12,685	6,206
1943	6,350	12,474	189	19,014	15,014	2,626
1944	6,460	20,569	196	27,224	27,488	2,813
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1949:						
Dec.	2,172	1,993	58	4,222	5,339	10,713
1950:						
Jan.	3,090	2,164	58	5,312	5,629	10,926
Feb.	3,245	2,307	58	5,610	5,803	11,059
Mar.	2,831	2,842	61	5,733	6,223	11,432
Apr.	2,975	3,051	69	6,094	6,285	11,710
May	3,116	3,517	55	6,688	7,089	12,110
June	4,059	4,332	68	8,459	7,537	11,248

Source: The Rubber Manufacturers Association, Inc.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1930	16½	7½	11.98
1911	184	114	141.30	1931	8⅜	4¼	6.17
1912	140	108	121.60	1932	4¾	2½	3.49
1913	113	59	82.04	1933	9⅞	2⅜	5.96
1914	93	56	65.33	1934	15⅞	8¾	12.92
1915	79	58½	65.83	1935	13¾	10½	12.37
1916	102	55	72.50	1936	23	13½	16.41
1917	90	52	72.23	1937	26⅞	14	19.39
1918	70	40	60.15	1938	17⅞	10¼	14.64
1919	57	38½	48.70	1939	24	14⅛	17.57
1920	56½	16	36.30	1940	24	18¼	20.10
1921	21¼	11½	16.36	1941	24⅞	19⅛	22.40
1922	28⅜	13⅜	17.50	1942	22½	22½	22.50
1923	37⅛	24¾	29.45	1943	22½	22½	22.50
1924	40⅝	17⅜	26.20	1944	22½	22½	22.50
1925	121	34⅛	72.46	1945	22½	22½	22.50
1926	88½	36¾	48.50	1946	22½	22½	22.50
1927	41¾	33	37.72	1947	25	14	20.00
1928	41¼	17	22.48	1948	25	18	21.99
1929	26⅞	15½	20.55	1949	19¾	15⅞	17.57

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1943	1944	1945	1946	1947	1948	1949	1950
Jan.	21.34	20.76	22.36	25.49	32.58	36.09	33.37	31.89
Feb.	21.61	21.34	22.29	26.57	33.91	33.63	33.41	**32.79**
Mar.	21.98	21.65	22.43	27.52	35.89	35.04	33.44	32.65
Apr.	22.02	21.71	21.88	28.40	35.89	38.10	33.84	33.23
May	21.97	21.63	23.30	28.17	36.51	38.57	33.73	33.64
June	21.92	23.31	23.42	29.89	37.83	38.12	33.56	34.61
July	21.46	22.33	23.27	34.11	38.03	34.89	32.99	38.11
Aug.	21.09	22.11	23.10	36.31	34.83	32.23	32.06	38.93
Sept.	21.10	22.10	23.25	37.59	32.21	31.92	30.94	....
Oct.	21.00	22.32	23.85	36.79	32.39	32.01	30.32	....
Nov.	20.32	22.13	24.71	31.50	34.50	32.15	30.52	....
Dec.	20.32	22.28	25.21	33.03	36.74	32.90	31.08	....
Average for Year	21.34	21.89	23.25	31.28	35.11	34.64	32.44	....

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film[a]	Textile and Paper Coating Resins[b]	Molding and Extrusion Materials[b]	All Other[b, c]
1946	52,080	11,673	61,852	27,083
1947	66,430	17,237	73,114	27,064
1948	**98,021**	**31,085**	**73,598**	**21,147**
1949	157,544	29,470	81,842	19,792
1950:				
Mar.	20,676	3,990	9,533	1,989
Apr.	18,675	4,076	9,513	2,068
May	18,692	3,539	9,998	1,648
June	16,740	3,560	9,569	1,712

Source: Bureau of the Census.

Notes: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting; (b) Resin content; (c) Includes Adhesives, but excludes data for protective coating resins.

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From the Pine Tree

ROSIN OIL
PINE TAR
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GALEX a non-oxidizing RESIN
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PANAFLEX BN-1
EXCELLENT FOR Light Colored PRODUCTS!

PANAFLEX BN-1 is an economical, light-colored plasticizer for synthetic rubber — especially butadiene-acrylonitrile type.

This new hydrocarbon plasticizer *completely* replaces dibutyl phthalate in nitrile rubbers — produces soft vulcanizates having high tensile, excellent elongation, and very low modulus. **PANAFLEX BN-1** plasticized stocks possess good ageing properties, superior electrical characteristics, and show good gasoline and oil resistance.

SPECIFY GRAVITY	0.9440
COLOR, NPA	1½
REFRACTIVE INDEX	1.553
DISTILLATION, °F	560-730
ODOR	Excellent
VISCOSITY, SSU @ 100°F	240

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Pan American Refining Corp
Pan American Chemicals

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PAN AMERICAN

Plant
Texas City, Texas

Rubber Industry Employment, Wages and Hours

All Rubber Products

	1949				1950			
Mo.	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
Jan.	201	$56.89	37.9	$1.501	187	$60.52	39.4	$1.536
Feb.	197	56.55	37.7	1.500	188	59.90	39.2	1.528
Mar.	194	55.43	37.0	1.498	189	59.70	39.3	1.519
Apr.	190	55.50	36.9	1.504	190	61.80	40.0	1.545
May	185	57.08	37.7	1.514	194	64.40	41.1	1.567
June	181	58.29	38.2	1.526	197	....	...	....
July	177	58.37	38.4	1.520	...	....	..	....
Aug.	180	57.72	38.3	1.507	...	....	..	....
Sept.	167	60.97	40.3	1.513	...	....	..	....
Oct.	187	59.57	39.4	1.512	...	....	..	....
Nov.	186	57.91	38.4	1.508	...	...	..	....
Dec.	187	59.04	39.2	1.506	...	....	...	....

Tires and Tubes

Jan.	91.3	60.72	35.3	1.720	82.6	67.70	38.4	1.763
Feb.	89.4	60.99	35.4	1.723	83.1	67.22	38.3	1.755
Mar.	88.6	61.50	35.8	1.718	83.4	65.26	37.4	1.745
Apr.	88.6	60.92	35.4	1.721	84.0	69.23	39.0	1.775
May	87.2	63.20	36.3	1.741	85.7	74.68	41.1	1.817
June	86.3	64.09	36.6	1.751	...	....	...	....
July	82.0	64.45	36.6	1.761	...	....	...	....
Aug.	80.9	62.32	36.0	1.731	...	....	...	....
Sept.	64.3	70.03	39.1	1.791	...	....	...	....
Oct.	81.1	64.83	37.3	1.738	...	....	...	....
Nov.	81.3	63.91	36.9	1.732	...	....	...	....
Dec.	82.1	64.79	37.3	1.737	...	....	...	....

Rubber Footwear

Jan.	24.8	51.86	40.2	1.290	20.1	45.87	35.7	1.285
Feb.	22.9	48.15	37.5	1.284	18.8	43.06	34.2	1.259
Mar.	21.9	42.07	33.6	1.252	19.4	51.04	40.0	1.276
Apr.	21.4	46.65	37.2	1.254	19.3	50.36	39.5	1.275
May	20.5	49.45	38.9	1.257	19.1	50.20	39.4	1.274
June	19.8	50.35	39.4	1.278	...	....	...	....
July	20.2	48.84	38.7	1.262	...	....	...	....
Aug.	20.3	48.78	38.9	1.254	...	....	...	....
Sept.	21.1	51.71	40.4	1.280	...	....	...	....
Oct.	21.5	49.81	39.1	1.274	...	....	...	....
Nov.	22.2	50.51	39.9	1.266	...	....	...	....
Dec.	22.1	50.23	39.8	1.262	...	....	...	....

All Other Rubber Products

Jan.	85.3	54.38	40.2	1.356	84.5	57.04	41.3	1.381
Feb.	85.1	54.05	40.1	1.348	86.3	56.43	41.1	1.373
Mar.	83.1	52.49	39.2	1.339	86.2	56.16	40.9	1.373
Apr.	79.6	51.69	38.4	1.346	86.8	57.21	41.1	1.392
May	77.2	52.51	39.1	1.343	88.7	57.60	41.5	1.388
June	75.3	53.85	39.8	1.353	...	....	...	....
July	74.5	54.11	40.2	1.346	...	....	...	....
Aug.	78.6	52.46	40.6	1.366	...	....	...	....
Sept.	81.4	56.28	41.2	1.366	...	....	...	....
Oct.	84.4	57.06	41.5	1.375	...	....	...	....
Nov.	82.8	54.04	39.5	1.368	...	....	...	....
Dec.	82.7	55.66	40.9	1.361	...	....	...	....

Source: U. S. Departments of Commerce and Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who worked during or received pay for the pay period ending nearest the 15th of the month. The employment series have been adjusted to levels indicated by Federal Security Agency data for 1947, and have been carried forward from 1947 bench-mark levels, thereby providing consistent series. Hours and earning data pertain only to production and related workers.

Production Index for the Rubber Industry

Production 1935-1939 = 100

(Based on man-hours)

	1948	1949	1950		1948	1949	1950
Jan.	223	193	194	July	200	175	...
Feb.	215	188	195	Aug.	207	178	...
Mar.	205	182	197	Sept.	205	174	...
Apr.	200	177	202	Oct.	205	192	...
May	201	178	213	Nov.	203	187	...
June	205	178	220	Dec.	200	193	...

Source: U. S. Department of Commerce.

Sales by the Rubber Industry

(In Millions of Dollars)

	1948	1949	1950		1948	1949	1950
Jan.	271	260	276	July	331	271	...
Feb.	265	251	286	Aug.	331	295	...
Mar.	270	260	306	Sept.	317	277	...
Apr.	285	257	303	Oct.	294	262	...
May	273	248	337	Nov.	291	262	...
June	299	266	...	Dec.	280	266	...

Source: U. S. Department of Commerce.

Rubber Manufacturers' Inventories

(Based upon Book-Value)

(In Millions of Dollars)

	1948	1949	1950		1948	1949	1950
Jan.	608	661	558	July	648	625	...
Feb.	625	661	594	Aug.	641	586	...
Mar.	634	653	595	Sept.	661	562	...
Apr.	625	648	598	Oct.	650	537	...
May	632	650	609	Nov.	667	587	...
June	645	644	...	Dec.	650	584	...

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1943	1944	1945	1946	1947	1948	1949
Antimony, Primary:							
Short tons	.....	.....	.....	.....	39	41	.....
% of total	....	.....	..	.....	.002	.003	.....
Asphalt [a]							
Short tons	16,510	20,189	19,483	28,715	32,113	19,967	18,050
% of total	.005	.006	.005	.007	.007	.004	.003
Barite (Barytes):							
Short tons	8,000	10,000	10,000	20,000	17,000	18,000	14,000
% of total	3.9	2.9	2.1	4.4	3.1	2.85	2.53
Carbon Black:							
Short tons	236,737	369,015	402,193	470,732	471,790	424,038	.....
% of total	90.3	94.6	95.5	95.3	94.3	91.0	...
Clay, Kaolin:							
Short tons	50,964	59,588	109,936	162,393	166,201	176,965	197,341
% of total	5.5	6.8	11.7	12.3	11.5	11.3	13.1
Clay, Fire & Stoneware:							
Short tons	10,259	7,160	7,800	12,951	17,970	15,480	.....
% of total	0.2	0.1	0.1	0.2	0.2	0.2	..
Lime:							
Short tons	2,039	5,634	7,170	3,193	589	1,154	.....
% of total	0.03	0.09	0.12	0.05	0.01	0.02	...
Litharge:							
Short tons	4,302	3,023	1,864	2,131	2,205	2,835	....
% of total	3.8	2.2	1.3	1.6	1.3	1.8	...
Lithopone:							
Short tons	1,078	726	977	1,607	3,085	4,192	3,245
% of total	0.8	0.5	0.7	1.1	1.9	3.0	7.0
Mica, Ground:							
Short tons	3,063	1,137	3,715	4,951	3,900	12,275	....
% of total	6.0	2.2	7.1	8.0	6.0	19.0	...
Sulfur:							
Short tons	51,000	63,000	64,960	72,800	72,800	70,560	.....
% of total	1.8	1.9	2.0	2.2	1.8	1.7	...
Talc [b]							
Short tons	48,994	51,833	63,758*	65,980	71,840	66,226	53,414
% of total	11.8	13.0	16.0	14.4	13.9	13.0	.12
Zinc Oxide:							
Short tons	67,898	59,518	63,447	83,776	82,248	82,895	....
% of total	47.4	42.3	49.6	53.1	51.2	54.9	.....

Source: U. S. Bureau of Mines.

Notes: [a] Solid and semi-solid products of less than 200 penetration. [b] Includes prophyllite and ground soapstone. * Revised.

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